

# ICOB I 2018

INTERNATIONAL CONFERENCE ON BUSINESS INNOVATION

## PROCEEDINGS

1<sup>st</sup> INTERNATIONAL CONFERENCE ON  
BUSINESS INNOVATION

AUGUST 25<sup>th</sup> 2018

**BUSINESS RESURGENCE & GREEN LIVING**



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# THE 1<sup>ST</sup> INTERNATIONAL CONFERENCE ON BUSINESS INNOVATION

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Organized by

**NSBM Green University Town**

Colombo, Sri Lanka

25th of August 2018

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# CONFERENCE AGENDA

- |               |   |
|---------------|---|
| 08.30 - 09.45 | Morning Tea & Registration  |
| 10.00 - 10.05 | Lighting of the Traditional Oil Lamp  |
| 10.05 - 10.10 | Welcome Speech by <b>Mr. P. Ranepura</b><br>Chairman, NSBM Green University Town  |
| 10.10 - 10.15 | Objective Statement of ICOBI by <b>Mr. J. Baratha Dodankotuwa</b><br>Head, Academic Development & Quality Assurance                                     |
| 10.15 - 10.30 | Speech, <b>Hon. Dr. Sarath Amunugama</b><br>Minister of Science, Technology, Research, Skills Development and Vocational Training & Kandyan Heritage    |
| 10.30 - 10.35 | Introduction of Keynote Speaker by <b>Dr. Sanjaya Dissanayake</b><br>Coordinator, Research and Postgraduate Studies                                     |
| 10.35 - 11.15 | Keynote Address by <b>Prof. Mohan Munasinghe</b><br>Nobel Co-laureate on Peace Representing IPCC-AR4  |
| 11.15 - 11.30 | Tea Break   |
| 11.30 - 11.50 | Presentation 01: Innovation Soft and Hard: Going Green in Red China<br><b>Dr. John Hulpke and Cubie Lau</b><br>University College Dublin, Ireland       |
| 11.50 - 12.10 | Presentation 02: IP Solutions for Green Technologies:<br>Prospects and Challenges for Sri Lanka<br><b>Dr. N. S. Punchihewa</b><br>University of Colombo |
| 12.15         | Official Photograph   |
| 12.15 - 13.00 | Lunch   |
| 13.00 Onwards | Panel Sessions  |



# PREFACE

NSBM Green University Town is honored to present its first International Conference on Business Innovation (ICOBI) on 25th August 2018 at its lush green campus premises, the first of its kind in South Asia. The theme of this first International Conference, "Business Resurgence and Green Living" has been the objective for many people, movements, and ideologies over the past decades. The generations of today are responsible for the living conditions of the generations of tomorrow, hence the Academic Development and Quality Assurance Unit of NSBM Green University Town will host its first international research conference to bring together like-minded people with the passion to build a discourse on several tracks, with the primary focus on how innovation can resurge businesses towards global green living.

The conference format consists of the inauguration ceremony in the morning with panel discussions scheduled for the afternoon. The papers published in the proceedings have undergone a double blinded review process. Three parallel panel discussions will be held initially in the afternoon and another three parallel sessions will follow, each on a specific theme, to provide each paper with adequate time for presentation and to accommodate all of them within the overall time allocated. Five to six papers presented at the conference will be published in the NSBM Journal of Management which is a refereed

journal, published bi-annually, currently going into its third year of publication. The journal has been the ideal medium, enabling the dissemination of findings of the research of scholars and practitioners in matters of importance to organizations and the society.

Further, the generous support extended by the Honorable Minister Dr. Sarath Amunugama, Minister of Science, Technology, Research, Skills Development and Vocational Training & Kandyan Heritage and other ministry officials are greatly acknowledged. A note of thanks is extended to the Chairman, NSBM Green University Town, Mr. P Ranepura who has guided the conference to great heights. Further, it is our privilege to acknowledge the guidance and the support extended by Dr. E A Weerasinghe, the Vice Chancellor of NSBM Green University Town. His visionary leadership was the driving force towards the success of this conference. A sincere appreciation is extended to the Deputy Vice Chancellor, NSBM Green University Town Mr. Chaminda Rathnayaka for his constant support and guidance. We also express our sincere thanks to our keynote speaker Prof. Mohan Munasinghe, 2007 Nobel Co-Laureate who is recognized as a leading expert on sustainable development, climate change, energy and environment. We are indebted to the Head Academic Development and Quality Assurance, Mr J Baratha Dodankotuwa without whose expert input there would have been no conference. We also

acknowledge the tireless efforts and patience of Dr. Sanjaya Dissanayaka, Coordinator of Postgraduate Unit which has led the conference to success.

Further, we would like to express our deep appreciation and gratitude to all the Organizing Committee members of the ICOBI 2018 conference for their strenuous efforts. We are indebted to the referees for their invaluable comments on the papers. Without their dedication, it would be impossible to hold ICOBI 2018 successfully and to collect high quality papers to compile the conference proceedings. Our faculty members and staff are greatly appreciated for their constant support and dedication. Finally all the local and international presenters, participants and our sponsors are thanked for their fine contribution towards the implementation and success of this conference. ICOBI 2018 is more than just another conference, it's a place to stop and reflect, a place to inspire and be inspired, a place where bridges are built for good academic tradition of open, intellectual discourse.

We wish all attendees an enjoyable scientific gathering at NSBM Green University Town, Sri Lanka. We look forward to seeing all of you next year at the next chapter of our conference.

***The Conference Organizing  
Committee  
ICOBI 2018  
August 25, 2018  
Sri Lanka***

# MESSAGE FROM VICE CHANCELLOR OF NSBM



Dr. E.A. Weerasinghe  
Vice Chancellor  
National School of Business Management

It is with great pleasure that I convey my heartiest congratulations to the first International Conference on Business Innovation (ICOBI) 2018, at NSBM Green University Town, which has already acclaimed a historical milestone in our annual calendar.

Through this first International Conference, it is envisaged to share and disseminate information relevant to research and development, experiences encompassing important areas in Green living and Business Resurgence. We have now come to an era where a sustainable way of living is a life style and a self-reliant promoting way of living can be applied to almost every part of life. In this context, businesses are actually living systems, and these living systems are intimately entwined with the various living systems of society and our more-than-human world.

I believe this conference with the theme of Green Living and Business resurgence will be of topical interest to academia, enabling a productive discourse. Whilst congratulating all the presenters, I look forward to an exciting day of insightful presentations, intense dialogue and fostering of collegial relationships.

Most of all, I thank you, the participants, for enriching our annual conferences by your presence.

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## Design

Mr. Ashika K. Witiwalarachchi

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# Innovation soft and hard: Going green in Red China

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**Abstract**— We look at cases where firms have made innovations towards sustainability. After looking at specific examples we see a new way to categorize innovation. We see two different and distinct types of innovation, types that to date have not been explored in the literature. We categorize the observed innovations as soft and hard. Sometimes innovation for sustainability starts with PEOPLE. We call this SOFT innovation. Sometimes green innovation goes hand-in-hand with technological change. We categorize these as HARD innovation. We look at firms in China and see both types.

**Keywords**—sustainability, antecedents of innovation, hard innovation, soft innovation, environment, China

## I. ANTECEDENTS OF INNOVATION: CATEGORIZATION

Antecedents of innovation are important and have been investigated by many scholars (Cai and Li, 2018; Chen, Yi, Zhang, Li, 2018; Kirchherr, Reike, and Hekkert, 2017; Severo, Ferro and Dorion, 2017; van de Ven, 2016). We look at the existing literature, then look at cases where real firms have made innovations towards sustainability. After looking at these specific examples from China we see a possible new way to categorize innovation. In our firms, we see two different and distinct types of innovation, two types that to date have not yet been explored in the literature. We categorize the observed innovations as soft and hard. Our new categorization does not reject the possible utility of existing innovation categorization schemes (Rosch, 1988) but does look at factors leading to innovation from a new perspective, using a different set of lenses.

Sometimes the key to organizational innovation for sustainability is preceded by or accompanied by insights and practices of PEOPLE. We copy Mintzberg's terminology (1994) and call this SOFT innovation. To change the organization, change the mindsets of PEOPLE. Sometimes green innovation goes hand-in-hand with technological change, breakthroughs in for example cleaner production. Again, following terms used by Mintzberg, we categorize these types of changes HARD innovation. Similar terms are used by others as well (Zeng, Phan and Matsui, 2015).

A table may help show general outlines of the two dimensions

TABLE I. TWO WAYS TO SEE INNOVATION

hard or soft	<i><b>Hard Innovation</b></i>	<i><b>Soft Innovation</b></i>
	<i><b>HARD: Relating to</b></i>	<i><b>SOFT: Relating to</b></i>
can be seen as	<i>relating to things, machines, numbers, dollars, processes, lean manufacturing</i>	<i>relating to individuals, organizational culture, people, teams</i>

In the following pages we use examples from real organizations operating in the world's second largest economy China. Looking at innovation as hard or soft appears to help build understanding of adoption of sustainability practices. We encourage others to investigate whether categorization of innovation to hard/soft can lead to better understanding of the process of innovation in general, in many or perhaps in all fields.

China deserves our attention for several reasons. As one report says, "China is now facing the worst air pollution problem in the world" and has "surpassed the United States as the country emitting the most carbon dioxide (CO<sub>2</sub>)" (Kan, Chen, and Tong 2012). But it is not only the air but also the water in China that is a major concern. One Guardian article stated that in 2015, 85% of Shanghai's water in the major rivers was undrinkable, 39.9% of Beijing's water could not be used for any purpose and 80% of water from major rivers was unfit for human contact (Tingting 2017).

Environmental problems in China are not new but have increased dramatically as a result of the explosive growth since opening and reform beginning around 1978. One report from the World Bank (2007) showed that six out of the world's most polluted cities were in China. By 2018, the problems are worse. Images of citizens choking on hazardous smog and polluted rivers and waterways are regularly seen on television news and newspaper headlines. China's economic growth has seriously affected its air and water quality. For example, record numbers of children are being treated for respiratory illnesses, most of which doctors and patients blame on air pollution (Cavaliere, 2013). Due to the high levels of pollution, The World Bank estimates that Chinese farmers are four times more likely to die from liver cancer and twice as likely to die from stomach cancer than the global average (Cousteau 2013). These environmental problems have a catastrophic impact on the Chinese economy as well as its people. The World Bank estimates that environment-related healthcare costs have an impact on China's economy of between 3.8% and 4.3% of GDP annually (Bedin *et al.* 2012). China's Ministry of Ecology and Environment reported that the number of sources of pollution in the country stands at about 9,000, compared to 5,900 in its first census in 2010 (Kuo, 2018).

China deserves our study, but the main contribution of this paper is not about environmental problems, as severe as they may be. Our main point has to do with ways to understand innovation. With no innovation, it will not be possible to solve environmental problems in China or for that matter anywhere (Balakrishnan, 2018; Said, 2015).

The business press frequently points out the need for innovation: "Innovation Is Crucial To Your Organization's Long-Term Success" (Henderson, 2017; Posner and Mangelsdorf, 2017). Academics often say the same thing. As one expert said bluntly many years ago, "It is impossible



to get away from innovation” (Amabile, 1988, p.124). The same expert says more recently “...attention to creativity and innovation has increased dramatically...” (Amabile and Pratt, 2016:1). This is true of business in general, but the problems of environmental sustainability are of such complexity and such severity that innovation is, to repeat Amabile’s term, “crucial.”

## II. HARD INNOVATION TOWARDS SUSTAINABILITY

The German chemical giant BASF is seen by many observers as one of the world’s most significant chemical businesses. The firm is seen as a leader in environmental sustainability. Also, as Senior Vice President Eduardo Leduc states, “Innovation is fundamental to what we do – it is our core business” (Leduc, 2018). On site visits to BASF facilities in China and discussions with BASF personnel support these ideas. From our perspective, key breakthroughs in sustainability at BASF owe much of their success to engineering excellence. BASF is proud of their “verbund” approach: emissions or by-products of one plant are not sent to landfill but are used as the starting materials of a different product or system. With verbund production processes consume less energy, produce higher yields and conserve resources, producing savings on raw materials and energy while simultaneously minimizing emissions. As one description explains, verbund “uses raw materials, energy and intermediates efficiently, re-use byproducts and residual materials, and keep the distances that substances need to be transported to a minimum. This reduces the impact on the environment and saves money” (Sterr and Ott, 2004, p. 948). While these brief descriptions are necessarily oversimplified, they are sufficient to make the point: VERBUND is an ENGINEERING approach, a technological answer to the problems of industrial impact on the environment. Pages, even books, could be written about this system, this approach. But for our purposes, verbund illustrates what we term HARD innovation. This information about BASF comes from publicly available sources such as published papers and web sites. On-site visits to the firm confirmed the information available publically. All information gained in interviews and visits which might be deemed as proprietary is not contained in this paper.

Similar examples of hard innovation, technological methods and processes that lead to a cleaner environment, can be found in firms such as Midea, a world leader in air conditioners and other electrical appliances. We also see technology harnessed for environmental improvement in Nanjing Steel, Tsingtao Beer, BYD, and others. (NOTE: This paper will outline the IDEAS of soft and hard innovation. Detailed descriptions of company examples are described in a separate paper.)

Academic attention to issues of sustainability has increased year by year, as environmental problems have increased. And often analysts and authors specifically connect innovation to steps towards solutions. A large portion of this attention is focused on solutions that we would categorize as hard innovation. A prime example would be the academic periodical *Journal of Cleaner Production*. The Journal “aims at helping societies become more sustainable” according to the first page of each issue. This journal is largely focused at solving the problems by what we would call hard innovation. A typical paper asks,

“Why do firms engage in environmental management? An empirical study in China” (Yuan, Ge, Liu, and Bu, 2008). Here we have an example of an entire journal directly on our topic and seeing solutions primarily as “production” problems, not so much as “people” problems (Matus, Xiao, and Zimmerman, 2012; Park, Sarkis, and Wu, 2010).

The world’s awakening relating to the significance of the environment came at least in part from Rachel Carson’s book, *Silent Spring* (Walker and Walsh, 2012). Her book might be seen as an example of one human making a difference, soft innovation. But we see *Silent Spring* as an example of hard innovation: her frightening vision of the future was based in hard scientific study. The California Brown Pelicans were dying off, and without painstaking research no one would have guessed that the cracking eggs in the pelican nests in the Channel Islands were cracking because of DDT being used in orange tree orchards miles away on the California mainland. That DDT found its way into insects which then found their way inside fish which were then consumed by female Pelicans, and ultimately destroyed the egg-shell making capability of the DDT impacted birds. Hard science made this discovery possible.

Governments responded to the information in the book in many ways. One US Senator, in a Congressional Hearing about improving environmental regulations where Carson was about to speak, said “You are the lady who started all this” (Stoll, 2012). US President John F. Kennedy openly praised her work and the science that it contained. Although we classify this investigation as hard science leading to hard innovation, the role of individuals is also important. When science is less important and individuals are most important, we would classify the resulting environmental improvements as stemming from soft innovation.

## III. SOFT INNOVATION TOWARDS SUSTAINABILITY

Although the end result in many cases would be the same, an improved environment, in some firms the impetus seems to start with people more than engineering processes. One example is CNOOC, the China National Offshore Oil Corporation. Although people in CNOOC are rightly proud of their engineering solutions to environmental issues, what struck us was the cultural side, the people perspective. It appeared to us as outsiders that environmental innovation and successes at CNOOC owe a lot to grass roots people support within the firm. Many examples could be used but one may help bring to life the concept we call soft innovation. In one of the regional headquarters offices of CNOOC, one of the present authors happened to go to the ladies employee washroom. Along the fairly long walkway leading to that washroom were perhaps 20 cartoons beautifully framed nicely placed on the wall, all drawn by employees. All of the cartoons were about the importance of the environment and environmental sustainability. The fact that somebody in the organization collected the cartoons, and that many employees contributed their views (and their artistic talents), seems to us to capture the idea of soft innovation. Environmental innovations in the petrochemical industry require engineering involvement. But at CNOOC, the corporate atmosphere, the culture, the cartoons on the wall, set the stage for a cleaner China. At CNOOC, we see soft innovation.

Soft innovation, or people-based innovation, came first to our attention at a business conference in Shanghai some years ago. A speaker from the USA told the Chinese audience about his “awakening” to environmental issues. He had been successful as a CEO of a firm making floor coverings such as carpets. He read a book called “The Death of Birth” and was shocked at the damage humans were doing to the environment. He vowed to turn things around, and before his death a few years later Ray Anderson turned Interface Carpets into one of the cleanest in that industry. That was a case of ONE human making a difference, and he challenged the Chinese audience, as individuals, to make a difference.

One such individual might be Jack Ma, founder of Alibaba. Ma stepped back from his CEO role in 2013, and remains as Chairman of the group of companies. About his changing role, one reason he gave was that he wanted to spend time awakening China to its environmental problems. “Ma is making it his mission to get China to pay attention to its environmental mess. On May 10, he stepped down as CEO of Alibaba... The next day he took a new job, as chairman of the China board for the Nature Conservancy (TNC), one of the richest environmental groups in the world. TNC has generally been U.S.-focused, but the sheer size and influence of China ensure that global environmental and climate issues will increasingly be decided there. If China is going to change for the greener, it will need local champions. Ma has volunteered” (Walsh, 2013).

Ma’s companies are not in what would normally be considered high-polluting industries. The Alibaba Group has many many components relating primarily to e-commerce. Thus it would be expected to see the human drivers for environmental innovation here, soft innovation, as opposed to hard innovation. But other examples of soft innovation come from industries that are often thought of as high-polluting. One example would be Zhang Yin, who started her company by recycling paper waste. Zhang’s Nine Dragons Paper Company “turned trash into gold” (Yu, 2012), and at one point Zhang was China’s richest person, all from making cardboard boxes out of discarded paper. It was not her technology that we need to note, it was her innovative and timely ideas.

Another case worth considering relates to how specific events can change perception of environmental issues. One Chinese executive joined an expedition to the world’s highest mountain, Mount Everest. He reached the summit, elated with the prospect of being able to “see the entire world.” Instead he saw trash and discarded bottles. He changed his personal habits (he will not accept plastic bottled water on the rostrum when giving speeches). He also made organizational changes, another example of the human side of environmental innovation, soft innovation.

Today, many individuals in China have had similar “awakenings” and are leading innovation for sustainability. We see examples of soft innovation at Haier, Yantian International Container Terminals, Vanke China Real Estate group, and others.

#### IV. INNOVATION SOFT AND HARD: EITHER/OR?

The examples cited above help illustrate the concept and provide examples of hard and soft innovation. The idea of innovation contains the notion of “new” or “original.” Thus,

this dichotomy might be most useful in analyzing the “innovation” stage of “innovation,” that is, how do innovations START. Studying innovation by focusing at the beginning phase is consistent with the idea of micro-foundations. It can be useful to look at end results, for example clean environment, it is also useful to look at factors contributing to that clean environment, and in turn, looking at the antecedents or triggers of THOSE factors, and so on as far back as possible. In both soft and hard innovation we are looking at micro-phenomena. This is consistent with the thinking of Vroman: it “seems that most, if not all macro-phenomena exist by virtue of underlying micro-phenomena. Take away the underlying micro-phenomena and the macro-phenomena will disappear” (words by Vroman, cited in Abell, Felin and Foss, 2010: 389; Vroman, 2009).

Although our attention is at the initial stage of innovation, to the extent that innovation is seen as an on-going process, both hard and soft innovation might be present. For example, the first decades of the 21<sup>st</sup> century saw an explosion of discussion and research surrounding the concept called “lean.” While most of the components of lean thinking relate to what we call hard there is a human element also. Major components of “lean” include just-in-time (JIT), process focus, quality focus, set-up time reduction, machine maintenance, supplier and customer relationships, and total people involvement (Netland and Ferdows, 2014). Of these seven, the last two seem to best fit with what we call soft innovation while the other five are more about “things,” processes or numbers or machines, not so much about people.

Similarly, there has been a large amount of discussion, many papers, and even conferences and seminars on “design thinking” or as it is sometimes called simply “design.” Again, this approach fits best with what we call hard innovation. Design thinking, again oversimplified, is sometimes described as involving as “bringing principles, approaches, methods, and tools” used by “designers” to problem solving” (Liedtka, 2015. p. 926). There is an element of cult-like thinking surrounding this area which followers use Capital Letters to describe: they talk of Design Thinking (DT) rather than design thinking (Spee and Basaiawmoit, 2016). These authors describe the origins of “DT” as coming from engineering and engineering education (p. 1). Again, most of the large literature on design thinking is consistent with what we categorize as hard innovation.

#### V. INNOVATION SOFT AND HARD: QUESTIONS DESERVING ATTENTION

In our literature reviews and field visits in China we see examples of hard and soft innovation. There seem to be examples of successful environmental innovation where one type dominates. What is not known is whether innovation for environmental sustainability would be more sustainable, more durable, more significant, when both hard and soft are present. Further, we do not yet know, in cases where both hard and soft innovation are seen, which is more likely to occur first.

In any event, these areas deserve attention, and soon. By all accounts, the earth’s environmental alarm bells are ringing (Kluger et al, 2006; Whiteman, Walker, and Paolo, 2013) and China has some of the world’s biggest environmental problems. We will continue our investigations and encourage others to join us.

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# *CityTour* Bus Locator and Bus Booking Mobile Application

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**Abstract**—The public bus transportation system has the direct impact on economic development of the country. Scheduling, tracking and monitoring of the public bus transportation is one of the major issues for any public transportation sector. Currently, there are many vehicles tracking systems available using Global Positioning Systems (GPS) technology. At present, bus passengers are unable to gather enough information which would lead up to a stress-free bus ride. Under current conditions a passenger has to wait in the bus stand without having any prior idea about the buses. ‘CityTour’ application assists passengers and the conductor to use bus service in more stress-free, well-organized and a suggestive manner. “CityTour”, is the cross-platform application implemented with the sole purpose of addressing these problems a passenger has. The application will predict the next Bus’s arrival time, seat reservation and a rating which will give an indication regarding the quality of the service offered. Bus conductor has a say in whether a passenger gets a seat or not. ‘CityTour’ application enables the “real-time” passenger bus communication that would lead to a better collaboration and make their day-to-day work easier for both the parties.

**Keywords**—public bus transportation, estimated time, bus tracking, bus seat reservation.

## I. INTRODUCTION

Around 93 percent of population in Sri Lanka use buses as their day-to-day transport medium. To get to know the next bus’s arrival time, vacant seating facilities, and the quality of the service presented by a particular bus are some of the concerns a passenger may have before getting into a bus. ‘CityTour’ application will be useful for everybody involved with a bus ride. The project is to use the available technologies and create a system which will make day-to-day passenger-bus intercommunication easier. The system consists of two main mobile applications which will be used by the passengers and the conductor. ‘CityTour’ application assists passengers and the conductor to use bus service in more stress-free, well-organized and a suggestive manner. The application will predict the next bus’s arrival time, seat availability and a rating which will give an indication regarding the quality of the service offered. Bus conductor has a say in whether a passenger gets a seat or not. Complications that arise in situations involving these two parties will be reduced.

This software mainly focuses on making the bus rides more user friendly. The system will enable passengers to get an estimated time for the arrival of the transport; for the benefit of these passengers the application will give them a better idea about what is to be expected from the bus they

have selected using the reservation system available. This application will also have an interface for the bus counterpart in order to give them a say in reserving seats. These would be achieved by using multiple platforms which the application would be developed in. “CityTour” is a system that semi automates the bus travelling process. This is the best solution for overcoming problems faced by the passengers. This system will give a better way to make decisions more efficiently and effectively. Those decisions would factor to satisfy both the passengers, drivers and conductors than they would expect. By giving the ratings the system will also give a motivation to the passenger’s choice of traveling method.

## II. MATERIALS AND METHODS

Quite number of projects has been attentive to the development of GPS based transportation systems, which would minimize a user’s work. The web application system “CTA | Bus Tracker” [1] is a fine example that makes people to take transportation decisions easily. It takes the current location of the bus that a user requests and shows it in a map, so the user could time his/her arrival at a stop. A New Smart Parking System Infrastructure and Implementation [2], The Research and Implementation of China Railway Ticketing and Reservation System (TRS) [3], "The impact of online reviews on hotel booking intentions and perception of trust" [4], are some similar reservation systems. They are real time desktop application systems that use sensors to check reservation availability. Smart parking only considers the major cities for the application. These systems do not give exact information about the reservation, only the location is provided to the user. These systems have to use a particular database as a server. All these systems have a similar way of letting the user to select their desired seating accordingly. However, these systems do contain heaps of unwanted information that is not worthwhile, and they may cause the systems to crash.

The researches mentioned on above sections describe about the systems that are similar to the system that is implemented. This project is unique because the system will let the passenger know the condition of the bus and the quality of service offered by a bus. It also enables the passenger to reserve a specific seat he/she desires, and the application will be implemented for multiple platforms. Other systems, unlike “CityTour”, usually do not track busses in real time, which would give out an accurate estimate of arrival time. Since the application allows an ongoing user to rate and comment regarding the facilities given out by a bus, the other users who might travel in the

same bus in the future could take it into consideration because the rating system of the application would give out an assessment of the bus. Questioning people through a simple questionnaire on different levels who are currently involved with the system helped in finding requirements to build the new system. Questionnaire has been given out to passengers from different areas to obtain diverse opinions from them.

### III. CALCULATION AND RESULTS

When considering passengers opinions, suggestions through questionnaire, CityTour application system was primarily designed for only any bus route as a commencement stage for the application to be developed with its unique features. With the versioning of the system, effective new features will be added to the application. This hybrid mobile application contains Time Estimation, Alert Service, Location Tracking, Seat Reservation functionalities to the users. When two or more users can come into a clash if they reserve the same seat at the same time. Then the option would be given out to the bus conductor to sort it out according to the first come first serve basis. When a user selects a bus he/she easily find out the bus location via Google Map. Also, it shows the distance, estimated time in between the bus and the user. If the user cancels the reservation it will also be indicated in the conductor's mobile.

### IV. CONCLUSION AND DISCUSSION

The system was built to make it convenient for both passengers and bus drivers. Although the priority was always given to the passenger over the bus when it came to more significant issues. The main consideration was to offer services with effectiveness, which the other similar applications failed to provide.

The system was developed with the sole purpose of convenience for everyone involved with a bus ride. Though the primary goal of this research was to search the location of the nearest bus and also provide options such as booking seats for the passenger. The rating system gives the passenger a more described version of the service he/she can expect. Although the passenger is the one benefitting mostly from the application, the bus crew were not ignored. The bus crew can choose to confirm or cancel a requested reservation as they desire. This makes the project more appealing to the users and it will make their life easier in the process.

This application is mainly preferred for luxury bus services as there is a less hassle when it comes to services. If a bus driver/conductor wishes to use the application for their profession they should consult the App. development team to sign them up for the application. Both passengers and bus crew will not need a vast technological knowledge or language skills to operate the application.

### V. LIMITATIONS

- The user's phone should be GPS connected.
- The application must be updated with the addition of new buses along with the bus numbers as well as the bus timings and new routes.
- When mobile platforms get updated in the future, the application will also be altered accordingly to its new features and requirements.

### VI. FUTURE WORKS

If any data mining project started to collect and analyse these data after the application has been running for some time and a considerable amount of collective data is available, it will be beneficial in the near future to the Sri Lanka transport services as the data will give out informative suggestions regarding where to provide improved bus transport in the country. After the application gets proper funding, more routes with additional busses will be added later onwards in the application.

Inside the bus the conductor uses this mobile application. If for some reason, the conductor misplaces the mobile it will be a problem when it comes to check the booked seats. Therefore, as a solution for the future, it is better to have a permanent digital device mounted inside the bus with easy access to the conductor. After the booking, if the user can do payments for the booked seats using an online portal it will be beneficial to both parties. It will also have to include a refundable process for any cancellations of the bookings. Since the application is initially developed for Luxury and Semi-Luxury type busses, it is hoped to be developed for use in normal bus services as well. In order to achieve this, it is expected to have a suitable bus transportation system that runs in a particular manner or the system has to be enhanced and developed with a lot of improvements and carefully analysed routine.

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# PseudoJ: A Pseudo-code interpreter for transforming Pseudo-code into JAVA

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**Abstract**—*PseudoJ is a prototyping solution, which is aimed at transforming Hand-written pseudo-codes into corresponding JAVA syntaxes. The solution will speed-up the agile development process and makes it easier to prototype a software development. Users of the solution are presented with options to create new workspaces (new projects), create new PSJ (pseudo-code) files and start prototyping. Under a workspace, Major Input and Output panels are created which respectively are a Pseudo-code editor and a JAVA code editor. The solution takes inputs from both editors and generates / strengthen the JAVA code as the output. The transformation is live and users experience code generation at the same time they input while the core process is hidden from the user. PseudoJ at the core, uses a trained-data file (configuration file / a mapping) in order to predict JAVA syntaxes for a given pseudo-code statement. A trained-data file is needed because the code transformation process involves a lot of guesswork. At the heart of the program, Abstract Syntax Tree (AST) of JAVA is used to process JAVA syntax. The core-process is visualized and demonstrated. Regardless of the major input and output options, a mobile input solution is also implemented in order to capture hand-written text from a user, which makes prototyping even easier. The mobile solution uses OCR techniques and parses hand-written text into a digital pseudo-code input. PseudoJ is implement as a plugin for the Eclipse IDE. The goal is to take advantage of built-in code refactoring, compiler and debugger. Utilization and features are compared and contrasted with similar approaches with the demonstrations.*

**Keywords**—*pseudo-code, abstract syntax tree, prototyping, code transformation*

## I. INTRODUCTION

The PseudoJ project is aimed at generating corresponding JAVA syntaxes (JAVA program) for non-standard Pseudo-codes which involves a lot of guesswork and higher complexity for the project core. Despite that, the PseudoJ core which acts like an interpreter still requires some optimization and it is expected to optimize and change the Interpreter time to time with future versions of the product or depend on the ‘user prompt and self-learn method’. The core is finalized in a way that it could be self-optimized; with the usage and help of client, the interpreter optimizes its rules file (configuration file). The infrastructure is consisting of two major components.

### A. Pseudo-code Collectors

The pseudo-code collectors are used to imports Pseudo-code into the code editor for the purpose of parsing. An inbuilt component existing in the main system may function as a collector or any outside programs can also be function

as collectors to the main program. According to the current implementation three main collectors are defined. Two of them are inbuilt functionalities, which already resides in the Main program and one functionality is an outside program.

### B. Pseudo-code Parser

The parser receives collected Pseudo-code inputs from the Collectors and further analyses the Pseudo-code. Parser consists of a few major components, which are used to filter, process and standardize (brings the Pseudo-code into a standard format which the Parser could understand). The ultimate purpose of the Parser is to predict JAVA syntaxes from the given Pseudo-code. On behalf of that, Pseudo-code parser maintains a trained data file called (rule file) and its’ intended job is to optimize the Pseudo-code filtering process (Standardisation process). The final output can be exported to the code editors. The Pseudo-code parser is an independent unit of functionality, which serves as a service. Therefore, as an opinion, the Parser component could be implemented in a separate Web-Service, which enables to have different clients in different platforms and implements more Collectors.

## II. LITERATURE REVIEW

### A. Abstract Syntax Tree (AST)

According to (Eclipse, 2018), the Abstract Syntax Tree allows modifying a tree model and reflecting these modifications in the source code. The author further specifies that the Abstract Syntax Tree is comparable to the Document Object Model (DOM) in XML. Abstract Syntax Tree is a concept, which is, standardize for syntax organization and mapping. Many frameworks for different platforms are implemented using the AST concept. The current research implements the Abstract Syntax Tree framework available in Eclipse, which is the base for many powerful tools available in Eclipse IDE (Eclipse, 2018). Eclipse IDE provides AST support for JAVA, PHP and many other programming languages. The below diagram demonstrates the PHP flavour of the AST in Eclipse.

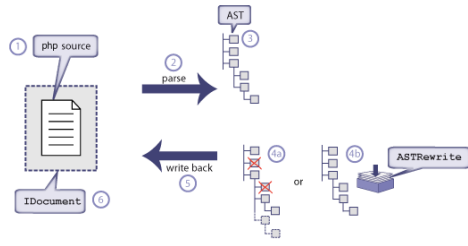


Fig. 1. The AST workflow; Source: (Eclipse, 2018)

AST does not hold pure syntaxes, instead components (Root Objects) related to the syntax component is held. AST is designed (pre-defined) to organise syntax components in a standard way. For an example a While Loop is stored at a parent node and the condition and assignments related to the While loop are stored at child nodes. See below diagram for an AST representation of a While Loop.

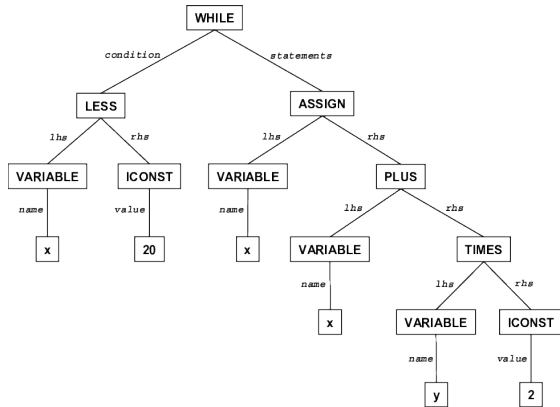


Fig. 2. AST for a While Loop; Source: (Fritzon, 2009)

AST parsers, Rewriters and many forms of modification methods are available in many platforms to modify their AST. Most of the platforms provide support for compilation of AST. Furthermore, there are many complex tools and programs are developed based on AST since manipulation of codes (Syntaxes) and detection of code patterns/ code changes could be implemented using AST. A few examples for such applications are Homology Detection systems, Source code plagiarism detection engines, Faster AST interpreters, Clone detection systems, Automated Quality Assurance systems, Source code pattern detection systems and etc.

Despite that, based on AST, there can be many business logics implemented which manipulates/ detects the source codes in a platform. AST enables easier access, management and organization of the source code in a Tree structure.

The conclusion for the AST is given by an author who has implemented a Source code Plagiarism detection tool using AST. The author (Baojiang Cui, 2010) mentions clearly their Source Code Plagiarism tool CCS is based on AST since AST is a data structure, which holds syntaxes in a syntactic manner.

### B. Prompt the User and Self-Learn

The Prompt the User and Self-learn concept is explicitly implemented in the PseudoJ plugin and is not a standard or existing concept. Despite that self-learning of computer programs have (at the time of writing this document), become the trend. There are many variations of these concepts such as Machine Learning, Deep Learning and etc. Self-learning concept involved with the Pseudo-code to JAVA syntax transformation is a basic level implementation of a self-learning program. The key idea here is to,

When the Statement-Resolver component in PseudoJ refers to the trained data set (rules file), if the pseudo-code statement (user input) contains unknown words which cannot be determined by referring the rules file, the program itself prompts user to map the unknown word with a known action / keyword in the rules file.

As the author (Singh, 2016) specifies, a Self-learning program has the ability to learn from the experience / take decisions based on the previous experience.

The same procedure applies here, the PseudoJ system polishes, optimizes its dictionary (rule set) with the experience it gains from its users. As the author further specifies, predictive computing is the self-decision-making approach of computer programs.

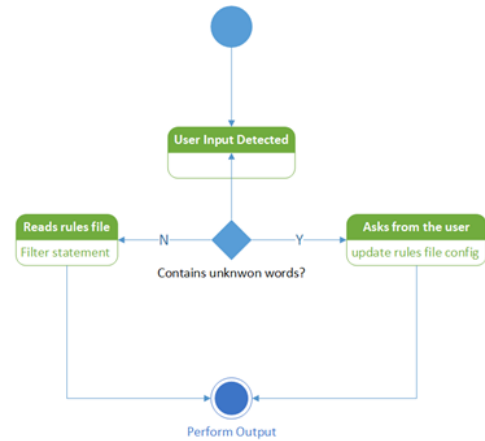


Fig. 3. The basic learning concept

### C. Simillar approaches based on simillar technologies

There are number of researches and implementations available which parsers codes. Most of the approaches are based on AST. Despite that, a few researches could be found in the area of Pseudo-code parsing since Pseudo-code is a non-standardised format of code representation.

#### Another Pseudo-code interpreter:

A better research conducted by (Gimeno, 2017) is also based on an AST to parse Pseudo-codes. (Gimeno, 2017)'s research is about implementing a complete IDE which interprets the Pseudocodes and runs. The research further says the interpreter perform an analysis called Lexical analysis by splitting pseudo-codes and standardizing them by converting them to tokens. The research further performs similar activity to the PseudoJ concept which Parses the generated tokens in to the output. Nevertheless, the PseudoJ

concept is not using a token generation instead it refers to its' rules file to filter out and standardize the pseudo-code segments.

There are few other approaches also based on AST but not interpreting Pseudo-codes.

#### A Domain Specific Language implementation which is similar to pseudo-codes, but standardised:

A separate simplified programming language implementation called **Modelica** (Fritzson, 2009) is also based on AST and interprets codes similar to pseudo-codes. But the authors introduce the language as a standardized language, which consist of standard, specific set of syntaxes.

```
while x < 20 loop
    x := x+y*2;
end while;
```

The Modelica language parsers, codes like above which are similar to pseudo-codes. They further specify that the implementation is a **Domain Specific Language** (DSL) as a language, which addresses a specific problem and is not an extension to current languages or a template of a current language.

#### An Eclipse plugin, which rewrites our JAVA, codes in a proper style:

Author (Arai, 2014) mentions that they have come up with an Eclipse plugin, which learns and rewrites JAVA codes while a user is coding.

The GUI organization and some set of opponents explained by Arai is showing similarities to PseudoJ concept. The approach is also based on AST. As they have come up with an Eclipse plugin, they have used the Eclipse AST.

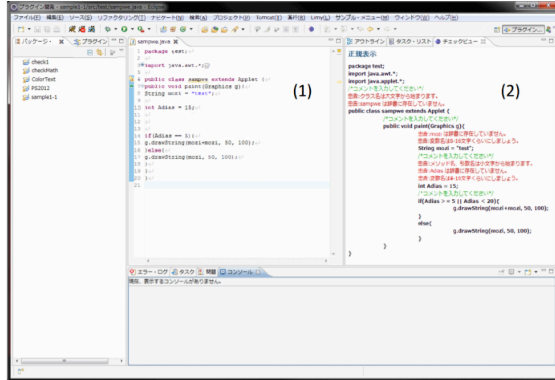


Fig. 4. JAVA code rewriter; source: (Arai, 2014)

The window organization looks similar to the one in the PseudoJ concept. The live code generation also demonstrates key similarities. Nevertheless, they have used an online approach of resolving unknown words, keywords. The program tries to contact a Restful web service implemented in a separate server and resolves unknown words by contacting word dictionaries. The data transferred here uses XML.

Moreover, Arai specifies that they've arranged automated comment outputs that alerts, warns and

recommends users with the quality styles of coding. Both the auto-commenting mechanism and JAVA code parsing mechanism is based on AST.

### III. METHOD OF APPROACH

The PseudoJ core is an integration of four major component types.

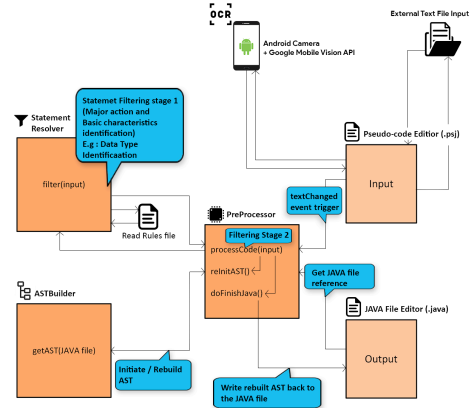


Fig. 5. Core architecture of PseudoJ concept

#### A. Pre-Processor

Pre-Processor consists of three major methods and a set of other helper methods. Respectively processCode (input), reInitAST() and doFinishJava () methods perform collection of code input from Collectors (input methods) and processing, instantiate and obtain an instance of AST and commit processed AST to a JAVA file. Pre-Processor **acts like the central agent** in the whole system since Pre-Processor associates and aggregates few other Helper classes (components) in the system. Pre-Processor maintains every state of the whole process. A few functionalities Pre-Processor further performs in order to maintain the state are,

- Opening and traversing through the rule set. (Pre-defined / trained data set).
- Contacting Statement Resolver to further filter / standardize a Pseudo-code statement.

#### B. Statement Resolver

Acts as a filter. Determines main action of a Pseudo-code statement received from Pre-Processor. Determines and identifies keys (e.g. Type declarations / Variable declarations / Conditions in conditional statements etc.) and related values. Statement-Resolver further associates with the rules file in order to identify keywords, pre-defined words in a statement. By doing that, the prediction process becomes less complex to the Pre-Processor.

#### C. AST-Builder

AST-Builder always obtains the current AST from the Compilation Unit. It contains a static method called



*getAST()*. Because of the static nature, it always returns the currently obtained AST within the program.

#### D. I/O Methods

Input/output methods are further described in detail under Section 4.2. Input methods acts as collectors, Pseudo-code importers to the program. The only implemented output method is JAVA syntax output via JAVA code editor.

### IV. WORKING PROTOTYPE

With the final implementation of the project, the completion of the PseudoJ core, input / output methods to the program and the mobile application is reported.

#### A. Pseudo-code Interpretation (Eclipse plugin)

The pseudo-code interpretation processor now recognizes most of the basic level pseudo-codes. A specific set of commonly used keywords is detected in order to predict the JAVA syntaxes at the moment. Hence, the program is now functioning based on a basic set of keywords and will be optimized with the help of prompt the user and Self-learn functionality implemented.

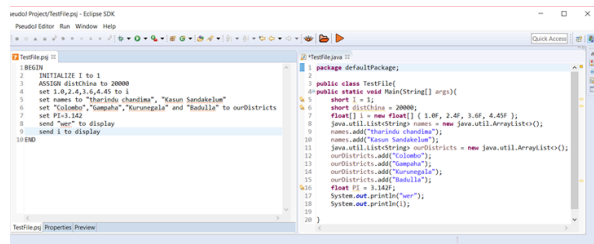


Fig. 6. Core architecture of PseudoJ concept

#### B. Input Methods

The eclipse plugin hosts three major input methods and a single option to compile (Build file) and run. The eclipse plugin features input methods such as direct pseudo-code text input, External pseudo-code import via .psj files or .txt files and External hard printed pseudo-code input via Android devices.

#### C. Mobile Application Input with OCR

The Mobile Application is implemented as a basic Android Camera application using Google Camera API and is bound with the Google Mobile Vision API in order to receive automated OCR functionalities. The complete application is a result of hybrid API configuration.

The Android Application is developed using Android Studio with Gradle Build.

### V. BUSINESS OBJECTIVES ACHIEVED

Writing programming syntaxes is not the valuable and major phase of developing a system. The Business logic of a program is the true back-end of a program. Programming languages are there for represent one's logic. At this point, the time taken to write down code lines is unnecessary.

'PseudoJ' is there for fulfill the need. 'PseudoJ' will automate the process at a maximum rate of accuracy possible. Still the operation is far from perfect. But the research can be extended in to a satisfactory level of result. These kinds of applications add value to businesses by making Testers, Unit testers, QA Engineers and developers more productive.

Prediction, Guesswork is always done by humans and was not a job related to software programs since computers are heavily logical. Nevertheless, with the evolution of self-learning concepts, computer programs now operate at a higher level than earlier.

Programs like PseudoJ consists of a frame and PseudoJ will try to fit different pseudo-codes from clients in to that frame. This objective is complex and may cost a few human employees in order to complete the job. The job referred here, most likely will be the prototyping which plays a major role in the modern Agile world.

- PseudoJ is not to auto-generate complete programs with Graphical User Interfaces (GUI). User attention and interaction is needed for large scale programs. Inspection of the auto-generated JAVA syntaxes will not take as much time as re-implementing the complete code from scratch.
- PseudoJ is not for generate exact JAVA syntaxes from a given pseudo code. A regular knowledge in programming is required from the developers to use PseudoJ as the IDE will not generate 100% accurate results. The PseudoJ IDE learns user specific keywords from the user. Learnt keywords and coding behavior will be used to optimize the accuracy of the IDE.
- The IDE's extension OCR scanner will be helpful for developers in order to save even more time. Also, the OCR scanner won't generate exact written characters as it on a paper. In this case, IDE allows users (developers) to manually edit both the generated Pseudo code and the JAVA syntaxes in a code editor.
- Developers will be able to save much time when implementing a complex logic which takes up-to many code lines! Developers and Designers will be able to work together and focus on the logic more. Finally, the overall quality of the product will be higher!
- Inbuilt self-optimizing mechanism will highlight (guess)/ Organize java classes for Objects that should be used inside the development.
- Live code generation:  
Code editors will refresh and react to user's every key press event. Commitments to code editors will result in live java code generation. User-Experience, product Quality will be considered here at its best.

## VI. CONCLUSION

PseudoJ research is a prediction tool, which predicts JAVA syntaxes out of Pseudo-codes. Pseudo-codes are used to define program/ business logic in a way that is closer to the human language. However, it's not standardized and is not a DSL (Domain Specific Language). PseudoJ blurs this boundary and makes prototype development easier. PseudoJ basically predicts relevant JAVA syntaxes for a given pseudocode. The program is currently based on JAVA AST provided by Eclipse and could be extended to other platforms also. It can be concluded that programs like PseudoJ makes the development, prototyping process easier, faster. In a business-oriented world, programs, which make the business processes faster, are assets for a business.

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# ICT Supported Interventions for Occupational Stress Management: Theory to Practice

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**Abstract—** Occupational stress has become a key source of stress among working population which has created numerous negative impacts on the community and of worldwide organizations, and they are expected to become a major health hazard in the forthcoming decades. During the investigation, the researcher will aim to identify the work- stress indicators and their impact on employee job performance. The study will also examine how employees cope with occupational stress whether the coping strategies are positive or negative. During the next round the researcher will design and develop ICT supported stress intervention toolkit for occupational stress management. ICT Supported health intervention is a phenomenon that has grown stronger in recent years. A large number of web and mobile-based health communities/applications has contributed to a shift: from formal healthcare providers being the only source of help for most patients to a situation in which patients take an active part in each other's struggle for health and recovery. Also, for people with different lifestyle issues, the health communities have become widely used for advice and support. Through the interaction with others, patients and other people with health concerns can get help to access relevant resources, develop their ability to make personal decisions and exercise critical thinking. They get support to develop skills and abilities along with a more positive self-image. This is also referred to as 'patient empowerment.'

**Keywords—** occupational stress, ict, digital, web, mobile, intervention, design concepts

## I. INTRODUCTION

Stress is a global phenomenon and a major healthcare challenge in the 21st century. Almost everyone exposed to a wide range of pressures in both personal life and work life. Some individual's cope very well with these demand, on the other hand, some individual's find it difficult to manage the situation, and that is when individuals fall into the "stress." Defining the term "stress" and categorization of stress type is a tedious task as the definition is uniquely personal. The term "stress" evolves after the 1920s and it is a form of the Middle English "destresse", derived via Old French from the Latin word 'stringere', "to draw tight" [1]. Modern-day father of stress, Hans Selye defined stress as "the non-specific response of the body to any demand for change" in 1936 and the same definition further expanded in 1979 as "stress is a 'perception'". In 1982 Holyroyd and Lazarus within their study, explained stress as "psychological stress requires a judgment that environmental and/or internal demands exceed the individual's resources for managing them". Skinner in 1985 defined stress as "a reaction of an individual to a stimulus event" whereas Eliot in 1988 determined "stress may be viewed as the body's response to any real or imagined event perceived as requiring some adaptive response and/or producing strain". Further,

Steinberg and Ritzmann in 1990 describe stress as an "underload or overload of matter, energy or information input to, or output from, a living system". Humphrey in 1992 considered stress as "any as any factor, acting internally or externally that makes difficult to adapt and that induces increased effort on the part of the person to maintain a state of equilibrium both internally and with the external environment". In the following year, McEwen and Mendelson described stress as a "term for certain types of experiences, as well as the body's responses to such experiences. The term generally refers to challenges, real or implied, to the homeostatic regulatory process of the organism". Later, in 1996 Levi described "stress is caused by a multitude of demands (stressors), such as an inadequate fit between what we need and what we are capable of, and what our environment offers and what it demands of us." Finally, in 1998, Roger described stress as a "preoccupation with the negative emotion following the event". Many other definitions established over the years by various researchers within their studies. However, the researchers are not able to develop a universal definition of stress considering its uniqueness and subjective nature.

Occupational stress is a branch of stress which associated with one's work environment or job conditions. The imbalance of occupational demand and supply will cause occupational stress; where high pressure, unrealistic goals, and expectations within the occupation does not match with an employee's knowledge, skills, and capacity. According to Vokic [2] occupational stress is the nonspecific response of the body to any demand placed upon it. It commonly believed that stress to a certain level is acceptable and considered positive. Whereas, the excessive amount of pressure regarded as negative or potentially harmful to both physical and mental wellbeing. Further, it is a physical and mental condition which has an impact on individual 's productivity, effectiveness, personal health, and quality of work.

According to International Labour Organization, ineptitudes caused by occupational stress cost up to 10 percent of a country's Gross National Production [3]. At an individual level, occupational stress causes a negative impact on both work life and personal life affecting the quality and wellbeing [4]. Nowadays, stress-related disorders are a major public health matter in many countries and many organizations and tend to increase in coming years. These disorders impact the economic and social environment of both individuals and organizations [5]. According to the analysis of three years' (2012-2014) worth of global Employee Assistance Programs conducted across Asia, Europe, Africa, North America, and South America covering more than 100,000 employees revealed a significant increase

in stress, anxiety, and depression [6]. Survey data shows a dramatic increase in the number of employees who are reporting serious mental and emotional health concerns. Further, collective, employee depression, anxiety, and stress accounts for 55.2 percent of all emotional health cases in 2012 compared to 82.6 percent in 2014. Similar outcomes identified at another survey conducted by American Psychological Association in 2017. According to survey results, 61 percent of employees commonly report feeling stressed or tense at work American Psychological Association [7]. Occupational stress statistics published by American Psychological Association in 2014 revealed that 35 percent of employees say that their job is harming their physical or emotional well-being. Another 42% say job pressures are interfering with their family or personal lives, 50% report more demanding workloads than they had a year ago, and 51% report lost productivity due to stress while at work [7]. Studies exploring the impact of work-related stress on organizational outcome have discovered forms of stress behavior affecting competitiveness, productivity, and the public image of the organization [8]. For example, besides the impact on workers' physical wellbeing, a poor psychosocial working environment contributing to work-related stress can result in increased absenteeism and presenteeism, as well as reduced commitment, motivation, and satisfaction, along with a greater rate of staff turnover and intention to quit [8].

Pestonjee [9] suggested three essential aspects of life from which stress originated, i) job and the organization, ii) social sector, and iii) intra-psyche sector. The job and organizational sector referred to the work environment. The social sector applied to the social and cultural context of individual's life. The last factor, the intrapsychic encompasses things which were intimate and personal to an individual. The present study has focused on the job and the organizational sector. Human behavior within an organization influenced by many factors, such as physical, social and psychological. What type of relationship employee had with the organization was defined by the term "role." Every individual in the organization had an assigned role to play. The role has defined set of responsibilities where an individual interacted and got interacted with the system. Therefore, an organization can consider as a system of the roles [10].

The interventions applied to occupational stress can categorize according to their scale [11]: individual and organizational. Furthermore, the interventions can also classify according to their purposes [11] such as identification, primary prevention methods, secondary prevention methods, and tertiary prevention or treatment. According to Schaufeli et al. [11], few well-designed studies are concerning the intervention in occupational stress. Also, these studies have demonstrated that the interventions studied benefit only a reduced number of people and are carried out by an instructor/therapist in a physical location. The use of Information and Communication Technologies (ICT) can help to improve the efficiency of interventions. Since it is possible to carry them out at a larger scale, regardless of time, place, or group of people [12] in the same

way, the user can access information in a quick, easy, and confidential manner [13].

This review was motivated by the research undertaken for the design and development of ICT supported toolkit for occupational stress management. The form of ICT supported interventions can be categorized into different clusters based on the digital platform used to deliver the content; mobile, web, computer applications or hybrid apps which use combinations of technologies. This robust mHealth, eHealth and iHealth interventions can now provide user-friendly and accessible tools such as customized information, online communities, personalized alerts, self-assessment tools, goal setting, and tracking tools, geolocation services, etc. The focus of the intervention strategy can categorize according to their scale [11]: individual and organizational. Furthermore, the interventions can classify according to their purposes [11] such as identification, primary prevention methods, secondary prevention methods, and tertiary prevention or treatment. As discussed above, the use of Information and Communication Technologies (ICT) can help to improve the efficiency of interventions, since it is possible to carry them out at a larger scale, regardless of time, place, or group of people [12]. In the same way, the user can access information in a quick, easy, and confidential manner [13]. The use of these ICT supported interventions have a significant role in identifying and overcoming stress-related disorders. Despite these potentials, the effectiveness of ICT supported stress interventions is not well understood. According to Schaufeli et al. [11], there are few well-designed studies concerning the intervention in occupational stress. Thus, this proposed review specifically aims to understand the design concepts, methodological implications considered and followed during the design and development process and practical limitations to yield optimum efficacy levels through ICT supported stress interventions.

#### DESIGN SELECTION

A design research study begins with selecting a problem to solve and a paradigm in which the research conducted. Morgan (1983) defined paradigm as scientific and philosophical methodological foundations in which a research process is carried out. A paradigm provides a platform in which researchers can interpret or explain their research. This platform often described a particular view of the "world" of the researcher [14]. In the proposed work considering the applicability and relevancy, the design science research [15], approach is proposed for building ICT supported stress artifacts. Design science research considered as an equal companion to natural science research in the information system field [15]. This approach motivated by the desire to improve the environment by introducing innovative artifacts and processes for building these artifacts [16].

Following figure describe the design science framework proposed for the design and implementation of ICT supported stress interventions.

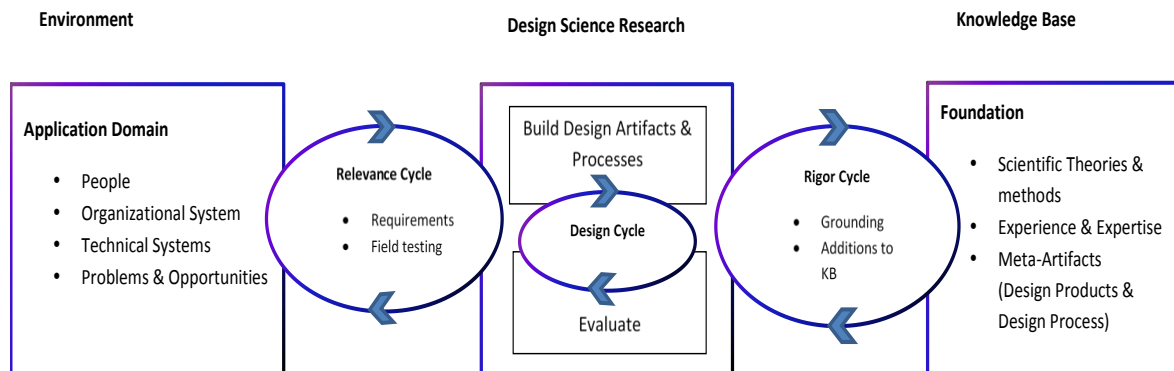


Figure 1: Research Foundation: Design Science Research Cycles based on Hevner (2007)

Design science research approach begins with the relevance cycle which attempts to identify the opportunities/problems in the actual application environment or by identifying new opportunities to improve practice before any problem recognized. The determined problems and opportunities will act as an input to the design cycle. Thus, during the study through the relevance cycle author will find the stress levels, sources of stress and stress coping mechanisms used at an individual and the organizational level within the work environment. The same relevance cycle act as a means of defining acceptance criteria for the final evaluation of the research results. The outcome of the design science research returned to the study environment for assessment in the application domain and will determine the deficiencies in functionality and usability of the result. The field-testing outcome reveals the modified requirements to the next iteration of the design cycle. During the study, at the evaluation phase of the intervention, the researcher aims to conduct pre and post evaluations of the response to identify whether artifact improves the stress levels among employees.

The rigor cycle of the design science research considered as the “brain” of the approach. The knowledge base of scientific theories and engineering methods identified at the rigor cycle provides the foundation for rigorous design science research. Additionally, experience and expertise in the application domain and existing artifacts and processes found in the similar environment will also add knowledge to the rigor cycle. In the same way, during the study, various stress-related theories and models will be examined to provide a theoretical foundation for the new artifact. Apart from the literature support, knowledge and experience of the stress experts and findings of the existing ICT supported stress interventions will be feed into the rigor cycle.

The design cycle act as the “heart” of the design science research. This cycle of research activities iterates rapidly between construction, evaluation, and feedback. The design cycle depends on relevance and rigor cycle for environmental and theoretical foundation respectively. Then the output of the design cycle feedback to the actual

application environment and knowledge base. The ICT supported stress management artifact will cater the practitioner audience where findings and experience gained through the research process will contribute to the knowledge audience.

## DISCUSSION

The findings of the review is also consistent with those of previous studies regarding major work-related stressors, effects of stress on health and the stress management strategies. But considering the sample size and selection strategies occupied during the study limits the transferability and generalizability of the findings beyond the study environment. Majority of interventions in burnout are carried out on an individual basis. It is also noted that interventions yielded a significant level of efficacy when the study is involved in participants with recognized high-stress scores. When persons who take responsibility for the treatment, they benefit more from unguided interventions. When considering the focus of the intervention respondents prefer tailormade treatments than following generic activities[17]. It is also noted that sending frequent, daily notifications may enhance exposure to intervention content without deterring continued engagement. These are major design concerns that need to focus at the design stage of the ICT intervention.

Societal implication of the research is noteworthy. ICT Supported health intervention is a phenomenon that has grown stronger in recent years. A large number of web and mobile-based health communities/applications has contributed to a shift from formal healthcare providers being the only source of help for most patients to a situation in which patients take an active part in each other’s struggle for health and recovery. Also, for people with different lifestyle issues, the health communities have become widely used for advice and support. Through the interaction with others, patients and other people and abilities along with a more positive self-image. This is also referred to as ‘patient empowerment’. With the outgrowing technology usage, field of health informatics also blooming in different directions. Evidence indicates that contemporary information and communication technologies (ICT) have the potential to support positively in health care sector via various mechanisms. Non-ICT based interventions are benefited only reduced number of people in a designated place and time whereas ICT enabled interventions support to

address larger audience in convenient manner without any geographical barriers. Moreover, ICT supported interventions may introduced as a method to identify the phenomenon, as a primary prevention method, as a secondary prevention method or even as a tertiary prevention or treatment while improving the efficiency of the intervention.

It's worthwhile to note that there's a clear gap appears to exist between work-stress theories and available ICT interventions for occupational stress management. It is also noted that no proper evaluation mechanism is available to measure the effectiveness of the ICT intervention. Thus, further research efforts are necessary to fulfill this theoretical and empirical gap.

Finally, the articles above described the state of the art of recently published studies related to interventions and methodologies adopted on occupational stress management based on ICT. The outcome of the analysis can consider as a guide for the design, development, and evaluation of future interventions.

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# Emotional Intelligence for Effective Leadership at Workplace: A Review

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**Abstract—** Leadership is a vital element in achieving organizational success. Intelligent leaders are essential to possess multiple intelligences in order to be successful. Emotional Intelligence (EI) has been a vital factor among multiple intelligences identified as required for effective leaders. The recent focus of management researches has been considering the importance of application of head and heart in the workplace to improve the performance of employees. Emotional Intelligence is identified as the means of connecting the thinking and feeling process of people. In leadership, dealing effectively with emotions may contribute to how one handles the needs of individuals, how one effectively motivates employees, and makes them 'feel' at work. Thus, the objective of this review is to explore the concept of Emotional Intelligence and to discuss its relevance to Effective leadership at workplace based on the existent literature.

**Keywords—** Emotional Intelligence, Leadership, Effective leadership, Job performance

## I. INTRODUCTION

The relevance of emotional intelligence (EI) to various aspects of human endeavour has become a subject of investigation in the last two decades. A central philosophical question that has historically divided groups of people is: Which is the better part of the human self, is it head or heart (Smith, 1992)? This age-old question relates to the entire range of human enterprises. However, it is only recently that management researchers have seriously considered the question in the context of the workplace.

This interest is being peaked by a desire of most organizations to improve employee performance. The interest of the research community in this search for efficiency is reflected in the attention it has given to job performance in recent past. Researchers (Bandura and Jourden, 1991; Bycio, Hackett and Alvares, 1990; Haque and Ali, 1998) had observed that job performance is the most extensively researched variable in both organizational behaviour and human resource management literatures.

The fountain of research associated with the study of effective performance surfacing in recent years is 'Emotional intelligence' (Goleman, 1995; Salovey and Mayer, 1990). Goleman (1998) defines emotional intelligence as the capacity for recognizing our own feelings and those of others, for motivating ourselves and for managing emotions well in ourselves and in our relationships.

The concept of leadership permeates and structures the practice of work organizations. In the management concepts, leadership has been defined in terms of traits, behaviour, contingency, power and occupation of an administrative position. Most of the definitions do reflect the assumption

that the leadership involves a process whereby a leader exerts influence upon others in an organization context in achieving set goals. A general opinion that is supported by research results is that leadership style in a firm, exerts a major influence on the structure, strategy and the wellbeing of the firm.

With this brief introduction, this paper introduces the methodology adopted in this review process and then deals with literature review on the concept of Emotional Intelligence, Relevance of Emotional Intelligence to Job Performance, Concept of Effective Leadership and then Relationship of Emotional Intelligence and Effective Leadership. Next section provides an author developed model as the discussion based on the findings and final section presents the conclusion..

## II. METHODOLOGY

To achieve the stated review objective, a systematic review of literature was conducted by using an archival method. This paper employs a methodology to review the articles cited in the databases Emerald, Sage, Taylor and Francis Online, Science Direct, and Wiley Online Library with related to the key words. Hence the study for this paper becomes a desk research rather than a survey or any other mode of researching.

## III. CONCEPT OF EMOTIONAL INTELLIGENCE

### A. What is "Intelligence"?

Success of an individual will be attributed to the intelligence that they possess. According to Garner (1993) intelligence is the ability to solve problems, or to create products, that are valued within one or more cultural settings. Anastasi (1992) explained Intelligence is not a single, unitary ability, but rather a composite of several functions. The term denotes that combination of abilities required for survival and advancement within a particular culture. It seems to us that in intelligence there is a fundamental faculty, the alteration or the lack of which, is of the utmost importance for practical life. This faculty is judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances (Binet, 1995).

Slatter (2001) indicated that Intelligence is part of the internal environment that shows through at the interface between person and external environment as a function of cognitive task demands. Therefore, a person possesses intelligence insofar as he has learned, or can learn, to adjust himself to his environment (Simonton, 2003).

According to Simonton (2003) Intelligence is certain set of cognitive capacities that enable an individual to adapt and thrive in any given environment they find themselves in, and those cognitive capacities include things like memory and retrieval, and problem solving and so forth. Further he states that there's a cluster of cognitive abilities that lead to successful adaptation to a wide range of environments.

#### *B. The intelligence of Emotional Intelligence*

There are multiple intelligences identified in literature such can be broadly grouped into three categories, i.e. abstract, concrete and social intelligence.

Emotional intelligence is a type of social intelligence that involves the ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide one's thinking and actions (Salovey & Mayer, 1993).

According to Prabhavathi (2012) first modern identification of social intelligence had been in 1920 by Edward Lee. According to his interpretation social intelligence is the ability to understand and manage men and women, boys and girls, to react wisely in human relations (Prabhavathi, 2012). The scope of emotional intelligence includes the verbal and nonverbal appraisal and expression of emotion, the regulation of emotion in the self and others, and the utilization of emotional content in problem solving. In fact Emotional intelligence is the interconnection between feelings and thinking process, i.e. 'thinking about feeling' (Chopra, 2010).

According to Chopra (2010) Socrates had believed that emotions, desires and appetites as influences for human motivation, and causes for moral actions of humans. Plato had asserted the fact that there are three basic components of human mind, the reasoning, the desiring, and the emotive parts and all learning has an emotional base. Further he indicates that Aristotal did not treat emotions as a separate agency within human, but they were treated as important in moral life, largely as a result of learning to feel the right emotions in the right circumstances. Sigmund Freud, the father of psychoanalysis argued that all psychic powers are significant only because they are connected with the liberation of emotions (Chopra, 2010).

Emotional Intelligence describes the abilities distinct from, but complementary to academic intelligence or purely cognitive capacities measured by IQ (Mishra and Mohapatra, 2010). According to Momeni (2009) Emotional Intelligence was defined as a collection of capabilities to perceive and integrate emotions through information channels to facilitate thought, understand and regulate emotions to promote personal and collective growth of society as a whole.

According to Momeni (2010) Emotional Intelligence refers to an ability to recognize the meaning of emotions and their relationships, and to reason and solve problems on the basis of them. Further he stated that Emotional Intelligence is involved in the capacity to perceive emotions, assimilate emotions related feelings, understand the information of those emotions, and manage them.

In accordance with Chopra (2010) "Emotional Intelligence is the capability and practice of observing oneself (self-emotional skills), developing personal potential and performance (interpersonal development), learning and practicing relationship management skills (management excellence) and adopting sociability and socio-economic understanding (socio-economic factors). Thus, the concept of emotional intelligence encompasses self-emotional intelligence and social intelligence within a psychological system. A person is said to be emotionally intelligent if he/she is capable of managing their own emotions, developing their own potential, managing relationships at work and successfully handling relationships at home and in society at large in order to handle pressures and challenges of a psychological system.

Goleman( 1995) further clarifies the fact that, Emotions are said to be working faster than the mind, thus emotions take greater power than mind to bend the perceptions among people, override emotional circuitry, and provide us with intuitive feelings instead it take the power of heart.

As cited in Mishra and Mohapatra (2010) Emotional Intelligence can be defined as a set of mental abilities to do with emotions and the processing of emotional information that are a part of, and contribute to, logical thought and intelligence in general. These abilities are arranged hierarchically from basic psychological processes to the more psychologically integrated and complex and are thought to develop with age and experience in much the same way as crystallized abilities. Moreover, they are considered to be independent of traits and talents and preferred ways of behaving (Salovey and Mayer, 1990). Therefore, Mishra and Mohapatra (2010) defines EI as the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; the ability to regulate emotions to promote emotional and intellectual growth.

#### IV. RELAVANCE OF EMOTIONAL INTELLIGENCE TO JOB PERFORMANCE

Emotional Intelligence has the potential to be a strong predictor of performance. Linking Emotional Intelligence with performance can provide organizations with a valid alternative for selecting and assessing employees (Hochschild, 1983). Many organizational researchers have recently had put more focus on the role of emotions at work. Emotions are indispensable and are an integral part of the organizational life as in more attentions should be placed on employee's emotional experience (Humphrey, 1993). Thus, in many scholarly works, emotional intelligence had been cited as a crucial contributor to organizational success.

Researchers agree that Emotional Intelligence will help an individual to gain high degree of productive value and it is considered as an ability that may have important results like reducing emotional behavioral problems (Chopra, 2010). According to Mishra and Mohapatra (2010) performance suffers in the organizations where the trust is lacking. Hence enhanced emotional intelligence skills will enable managers



to regulate their emotions and motivate themselves more effectively.

Mayer (1993) points out that if organizations work on relatively countless small emotional elements, management can impact on employees' emotional reactions and consequently their performance. Further, Organizational development, creativity, innovation, educational development and stress reduction are identified as benefits of high emotional intelligence (Chopra, 2010).

In accordance with Borman and Motowidlo (1997) Job performance is divided into two dimensions: task performance and contextual performance. Task performance refers to behaviours that are directly linked with completion of the job and consists of execution of technical processes and maintenance and servicing of technical requirements. Contextual performance, on the other hand, refers to interpersonal behaviours or actions that benefit the organization. It includes activities such as helping and cooperating with others, following organizational rules and procedures, and volunteering to carry out task activities. Salovey & Mayer (1993) redefined the above; contextual performance as 'Emotional Intelligence' that involves the ability to perceive accurately, appraise and express emotions, the ability to access and/or generate feelings when they facilitate through, the ability to understand emotions and the ability to regulate emotions to promote emotional and intellectual growth.

## V. CONCEPT OF EFFECTIVE LEADERSHIP

### A. What is "Leadership"?

Leadership, according to Levine and Crom (1994), "is about listening to people, supporting and encouraging them and involving them in the decision-making and problem-solving processing. It is about building teams and developing their ability to make skillful decisions." A leader is a person who takes the central roles in interactions and who influences the behaviour of other members of the group. He is an individual who has authority over others and is responsible for guiding their actions. He/she is a person engaged in the traditional management practices, such as planning, organizing, decision-making, and controlling, and whose performance is almost often measured by their ability to achieve the goals and objectives of the organization (Fatokun et al., 2010).

According to Humphrey (2002) Leadership is intrinsically an emotional process, whereby leaders recognize followers' emotional states, attempt to evoke emotions in followers, and then seek to manage followers' emotional states accordingly. The ability of leaders to influence the emotional climate can strongly influence performance (Humphrey, 2002). Pescosolido (2002) states that leaders increase group solidarity and morale by creating shared emotional experiences.

The earliest theories sought to establish the personal traits necessary for effective leaders. In mid 1940s leadership research centered on identifying the traits or personal characteristics of individual leaders. Such traits as honesty, loyalty, ambition, aggressiveness, initiative, and drive were deemed important. The earliest theories held that traits are inherited and certain leaders are born to be leaders. Traits are carried in the genes, and persons endowed with appropriate

traits were natural leaders. Later, these theories held that traits could also be developed through learning and experience. The current interest in alternative leadership paradigms in the 1980s, variously labeled transformational leadership (Tichy and Devenna, 1986), charismatic leadership (Conger and Kanungo, 1988) self-leadership (Manz and Sims, 1989) or principle-centered leadership (Covey, 1990) can be explained by understanding the pre-requisites of the resource-based strategy and human resource management model.

One important function of leadership is to develop others. Development of others happens through the transformational leadership. Transformational leadership belongs to one part of charismatic leadership (Conger, 1988). The term 'Charisma' carries the initial meaning of 'gift' in Greek, had been frequently used in politics and religions to adduce legitimacy to power (Antonakis, 2003). According to Antonakis (2003) Charismatic leaders inspires others and generates some excitement among them so they perform beyond expectations.

As per many studies that have been conducted, charismatic leadership has taken interactional approach as in focused primarily on the leader's personality traits or the profile of leader motives (Antonakis, 2003).

As per House and Howell (1992), Charismatic leadership was evidently established in two forms; personalized charismatic leadership and socialized charismatic leadership. Personal charismatic leadership is was identified as exploitative, non-egalitarian and self-aggrandizing. Thus, it is termed as the dark side of charismatic leadership hence it is not favorable to the followers and many have dangerous consequences to the followers as well as to the organization. Personalized charismatic leadership is also identified as pure charismatic leadership, and such leaders will attracts followers' attention, his or her vision and its merits will be convinced to the followers and establish a strong following. Yet pure charismatic leaders do not focus on developing followers in to leaders (Conger, 1988). Further, Pure charismatic leadership will perceive the autonomy of followers as a threat for their leadership thus they will avoid the development of followers intentionally.

Socialized charismatic leadership, is defined as being non-exploitative and motivating followers to maximize the gains of the organization regardless of leader's personal gains, and it is the area which is mostly researched in to (Antonakis, 2003). Characteristics of socialized charismatic leadership are that the leaders' effort is to assist followers by formulating high order goals which appeal to the followers' fundamental and enduring needs. Such will give followers the power to pursue such goals by themselves. The followers will not create blind dependences on leader as in the case of personalized charismatic leadership. Therefore, socialized charismatic leadership is more of the developmental leadership style (Antonakis, 2003).

Socialized charismatic leadership can be identified as the central characteristic in transformational process. Followers will emulate their leader. They will place a great trust in the charismatic leaders' judgment and the mission proposed by him. Followers will live in the values of the leader thereby develop deep emotional ties with the leader (Conger, 1988).

*B. Relevance of Leadership to Job Performance*

The essence of leadership in organizations is influencing and facilitating individual and collective efforts to accomplish shared objectives. Leaders can improve the performance of a team or organization by influencing the processes that determine performance (Yulk, 2012).

According to Glassman (1978) Effective leadership generates increased motivation and effort. Greater motivation and effort are factors that lead to high organizational performance. However, he believed that motivation is predispositions to act in certain manner such factors are needs, expectations, personalities and operant condition. For the leader, the challenge is determining on how these factors interact to affect individual behaviour and the work situations can be structured to attain maximum employee job performance.

Maslow (1970) identified five need categories which can serve as motivations and arranged them in hierarchical order, with physiological needs being the most basic. Although an individual can be manager without leading and an individual can be a leader without being a manager (for example, an informal group leader or elected trade union leader). A balance of management and leadership is necessary for a work organization to operate effectively.

Is'haq (2008) reported that intellectual stimulation leaders show the degree to which he provides encouragement to his subordinates to be creative in looking at old problems in new ways, create an environment that is tolerance of seemingly extreme positions, and nurture people to question their own values and beliefs and those of organization. According to Kerr (2005), Leadership is a process of social interaction where the leader's ability to influence the behaviour of their followers can strongly influence performance outcomes.

As cited in Walumbwa et al. (2008), Shamir et al. (1993) were among the first to link self-efficacy to transformational leadership in their self-concept motivation theory of leadership. According to Bandura (1997) Self-efficacy refers to an individual's belief in his or her capabilities to successfully accomplish a specific task or set of tasks. The authors suggested that self-efficacy is a possible mediating mechanism through which transformational leadership affects followers' performance. They further suggested that transformational leaders enhance followers' perception of self-efficacy by emphasizing positive visions, communicating high performance expectations, and expressing confidence in followers' abilities to contribute to the mission and goals of their organization.

As cited in Yulk (2012), More than half a century of research provides support for the conclusion that leaders can enhance the performance of a team, work unit, or organization by using a combination of specific task, relations, change, and external behaviors that are relevant for their situation. The behaviors those are important for effective leadership is explained better by theories about the determinants of group and organizational performance than by leadership theories focused on motivating individual followers. Hence, the author constructs that effectiveness of leadership needs to be determined by group and organizational performance.

VI. RELATIONSHIP OF EMAOTIONAL INTELLIGENCE AND EFFECTIVE LEADERSHIP

Emotional intelligence has become increasingly popular as a measure for identifying potentially effective leaders, and as a tool for developing effective leadership skills (Palmer et al., 2001).

During the last decade interpersonal skills have become more integral to effective leadership (Goleman, 1998). Where leadership is seen to control, plan and inspect the overall running of an organization, in today's more service-oriented industries, leadership roles are also to motivate and inspire others, to foster positive attitudes at work, and to create a sense of contribution and importance with and among employees (Hogan et al., 1994).

Leadership is intrinsically an emotional process, whereby leaders recognize followers' emotional states, attempt to evoke emotions in followers, and then seek to manage followers' emotional states accordingly (Humphrey, 2002). As cited in Kerr (2005) Pescosolido (2002) argues that leaders increase group solidarity and morale by creating shared emotional experiences. The ability of a leader to influence the emotional climate can strongly influence performance. (Humphrey, 2002)

According to Momeni (2009) employees' feeling about their workplace is the principle determinant of whenever the organization is a great place to work. He further elaborates employee three components of employee feeling about the place they work;

- Feeling about the management: an employee should trust the leaders he works for
- Feeling about the job: an employee should have pride in what he does
- Feeling about other employees: an employee should enjoy the people he works with

Research studied over three decades has shown that, more than 70% of the employees' perception about organizational climate is directly shaped by managers' style of leadership (Momeni, 2009). Further, how employee feels about their workplace, is mainly shaped by the management, and that creates the improved feeling about organizational climate (Momeni, 2009).

Goleman (1995) had discovered that bottom line performance of private sector organizations is mainly affected by the mood and behaviors of its leaders. A cranky and ruthless boss creates a toxic organization filled with negative under achievers who ignore opportunities whereas an inspirational, inclusive leader spawns acolytes for whom any challenge is surmountable.

The ultimate results of the organization which is profit or loss, an efficient leader with higher Emotional Intelligence will create an environment where loyal, intelligent and reward-seeking and emotionally invested employees striving towards great goals (Momeni (2009). As cited in Antonakis (2003) leaders who display anger or other

negative emotions will be ineffective and seen as unstable. In fact no matter the cause, the effect of the leaders' lack of emotional control negatively affects a team.

Goleman (1995) specifies that leader who is with lack of emotional control was related to leader ineffectiveness. In fact, charisma is, among others, an outgrowth of leader emotional appeals, which could be on a range of emotions including anger, disgust and so forth (Wasielewski, 1985).

As stated by Wasielewski (1985), a leaders' display of an emotion like anger is much more memorable if it is unctuated by first shaking, yelling and contorted doses, emotional outbursts can be useful, symbolic, and engender follower identification and trust, as long as these emotions reflect collective sentiments and moral aspirations.

Antonakis (2003) explains that Emotional Intelligence is necessary for leadership effectiveness and team functioning, proposing, among others that; the emotionally intelligent team leader will induce collective motivation in team members and the emotionally intelligent team leader uses charismatic authority and transformational influence in order to improve team performance. Essentially Emotional Intelligence is a foundation element of charisma and effectiveness, stating that high emotionally intelligent leaders empathize with others, appraise, predict, regulate and manage emotions in themselves and others which leads to improved team cohesiveness and motivation (Antonakis, 2003).

As cited in Kerr (2005), Emotional Intelligence is a key factor in an individual's ability to be socially effective (George, 2000; Mayer et al., 2000) and is viewed in leadership literature as a key determinant of effective leadership (Ashkanasy and Tse, 2000; Boal and Hooijberg, 2000; George, 2000). George (2000) had argued that emotionally intelligent leaders can promote effectiveness at all levels in organizations.

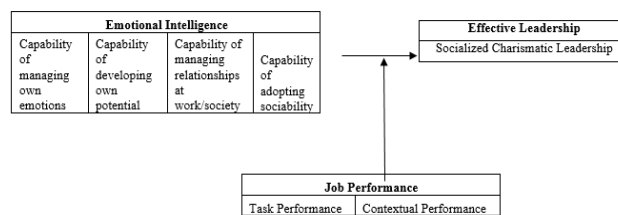
The Emotional Intelligence of the leader plays an important role in the quality and effectiveness of social interactions with other individuals (House and Aditya, 1996). Mayer et al. (2000) had explained that employees who have high levels of Emotional Intelligence may have smoother interactions with members of their work teams.

Salovey et al. (1999), found that individuals who rated highly in the ability to perceive accurately, understand, and appraise others' emotions were better able to respond flexibly to changes in their social environments and build supportive networks. Mayer et al. (2000) had proposed that a high level of Emotional Intelligence might enable a leader to be better able to monitor how work group members are feeling and take the appropriate action.

## VII. DISCUSSION

The above review of literature evidences, to a significant extent, the relationship of Emotional Intelligence on Effective Leadership and the moderating nature of Job Performance as a variable which makes the leadership

effective. Following figure illustrates a model constructed by the author based on the above review of literature.



## VIII. CONCLUSION

Based on this review, it is possible to conclude that Emotional intelligence has been found to be a strong predictor of work performance. Further, the above review of literature proves that effective leadership generates higher job performance. So, hiring and retaining leaders with higher levels of emotional intelligence will be associated with higher financial gains. Because emotional intelligence is so critical for the success of a learning organization, these attributes should become the global goals of every curriculum and training plan.

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# From Crisis to Character Leaping Through the Waves of Calamity- A Conceptual Framework

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**Abstract**— *A crisis is an unexpected change that poses a challenge to the natural equilibrium of an individual or an organization. All of us face crises during our lifetimes. However, some individuals thrive in crises emerging strong while others struggle. The Crisis to Character (C2C) Model was conceptualized to understand the process one goes through in the face of calamity. Research evidence based on the model will enable scientists and practitioners understand the process of recovery following a crisis, the meaning of old and new equilibriums and the factors that predict positive outcomes following a crisis. This model can also be used to draw cross-cultural comparisons.*

**Keywords**— *crisis, character building, resilience, wellbeing, holistic health, mental wellbeing, organizational psychology, trauma, recovery*

## I. INTRODUCTION

Often the term ‘organization’ is used to refer to a business or professional setting; however, individuals belong to organizations at various levels, with various purposes and these organizations are in constant interaction with each other. For example, family, social group, community, workplace, religious affiliations, country are some of the many organizations one may belong to. A sudden change in events that affect the equilibrium of an organization is considered to be a crisis (Miller & Iscoe, 1963). Hermann (1972) defined a crisis as a time-limited, unanticipated threat to the survival of a system. It can be an environmental event that has impending negative or harmful consequences for the entity (Staw et al., 1981). A crisis has a low probability of occurring, but poses a threat to the wellbeing of an organization or an individual (Jackson & Dutton, 1987). The word ‘crisis’ is exceedingly common in this day and age. Wars, crimes, natural disasters, sickness, death - they are crises we encounter on a daily basis as individuals and as organizations.

In organizations, a crisis is ‘a disruption that not only affects a system as a whole, but also has a threatening effect on its basic assumptions, its subjective sense of self, its existential core (Pauchant & Mitroff, 1992)’. Thus, a crisis is a “frame breaker” (Tushman et al., 1986) with emotional, cognitive and behavioural dimensions. In other words, crises drive organizations towards change (Englehardt & Simmons, 2002). This change can bring about positive outcomes (i.e. growth and stability) and/or negative outcomes (i.e. chaos and disruption).

While there are many studies exploring the links between specific factors that predict how one may face an adversity, there is a lack of understanding of the complex interactions and the underlying process of facing a crisis (Staw et al., 1981). This paper conceptualizes a holistic model capturing the course of adaptation following a crisis situation with the objectives of (1) defining the levels of old (i.e. prior to crisis) and new (i.e. following the crisis) equilibriums (2) exploring the factors result in a negative (i.e. quitting or negative coping mechanisms) and positive (i.e. thriving) outcomes following a crisis (3) understanding the underlying processes that enables some individuals to thrive while leading others to quit.

## II. CONCEPTUAL FRAMEWORK

### A. An Organization as a Human Being

The human body is an integrated system. It is a perfect metaphor to understand countries, communities and organizations, and to draw out the similarities in the functioning of a human being with that of these entities. Though the systems and functions are different, they all work together to achieve one final goal- maintenance of inner stability and growth. Like in the case of any living organism, the organization has to seek the following.

- a. Growth (the process by which living things increase in size or cell number): organizations grow in the size of the business and in the number of people.
- b. Nutrition (the process by which living things take in materials from their environment for growth and repair): organizations are fed by external resources such as new information, knowledge, innovation, clients, and customers who bring in revenue so that every mouth is fed.
- c. Transport (the process by which usable materials are taken in by absorption, and distributed throughout the organism by circulation- be it the interlinked blood stream, neural network or chemical systems): in organizations, information, knowledge and wisdom are absorbed at certain levels and circulated to the rest of the organization through communication channels.
- d. Synthesis (the process by which small, simple substances are combined chemically to form larger or complex substances): in organizations where

production takes place, materials are synthesised to create the final product. Likewise, individuals too come together to synthesise their ideas in groups, to invent and innovate complex products or fine-tuned services.

e. Excretion (the process by which living things remove waste products produced by cell activities): organizations have to remove what is redundant, be it material waste, or processes and individuals who do not carry the same values, who do not perform and are a burden to the entire system.

f. Reproduction (the process by which living things produce new living things of the same kind): organizations have to develop and prepare new leaders for the future. They need to build up their bench strength so that the legacy of the company will be continued long after they are gone.

Adapting to the external environment whilst maintaining the inner balance, defines the success of existence in both human beings and organizations. Synchronized growth is in the heart of thriving organizational cultures where the outer progression of a company, be it in the number of employees, revenue or market share, is aligned with the inner growth and stability in managing people and systems. People have to be grown from within and systems have to be fine-tuned to improve rigour and effectiveness for inner control and regulation. Henceforth this conceptual framework equates the growth and change process an individual to that of an organization.

#### B. From Crisis to Character Model

A crisis is a universal reality. It can be experienced by any individual or any entity at any time. Thus, crisis management is a skill that all must enhance to live holistically and increase preparedness to face adversity. While many practitioners and scientists focus on how to deal with a crisis following its occurrence, little evidence shows how one can prepare himself or herself for a crisis. Crises are a part and parcel of life, both internal and external. Some form of crisis and conflict is inevitable in any form or system. However, the problem lies less in the inherent nature of conflict but more in our response to it.

In order to (1) empirically conceptualize how an individual or an entity goes through a crisis, and (2) streamline the understanding we, as scientists, have of how one may go through a crisis situation, the Crisis to Character (C<sub>2</sub>C) model was developed.

This paper was written with the objective of presenting the C<sub>2</sub>C concept that will lead to further qualitative as well as quantitative research in the field of change management, organizational and personal growth, trauma recovery, post-traumatic growth and crisis management. It seeks to explore the levels of old (pre-existing) equilibrium and compare it to the level of new (following a crisis) equilibrium. A healthy individual, following a crisis, would have a more evolved mechanism in coping and also be more resilient. This is not a linear model. In other words, even though presented in a linear form for easy understanding, it is possible that an individual may fall back into a previous level repeatedly.

The model was put together after observation of many individuals and organizations. In addition, the C<sub>2</sub>C Model has been compared against many change theories in change management, transition psychology, and conflict theories. The concept of character in the model is compared with the idea of post-traumatic growth and the 'character strengths and virtues' (Seligman, 2004), from Positive Psychology. The C<sub>2</sub>C model (figure 1) is versatile in the way it applies to an individual, a family, organization, community, and a country as a whole. The definitions of the terms used in the model are presented in table 1 (See attachment for expansion of model).

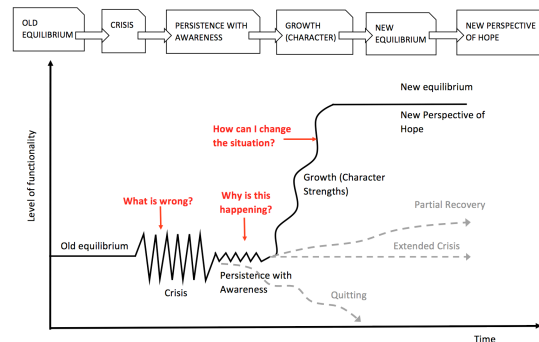


Fig. 7. From Crisis to Character Model: A Model of Change

TABLE II. DEFINITIONS OF TERMS USED IN THE C<sub>2</sub>C MODEL

Term	Definition
<b>Old Equilibrium</b>	The old state of balance or old status quo. The way things were, based on the way of thinking and comfort zone.
<b>Crisis</b>	Anything that disturbs the former status quo, i.e. an illness, a broken relationship, failure in career, etc. This stage is typified by shock, excitement, and even disbelief or numbness. Some may go through a period of denial, anger, and bargaining (Kübler-Ross, 1969) to regain the life as it was before the crisis. Persons might make provisional adjustments to minimise these negative emotions (Williams, 1999). In the growth model, this is the stage where they question 'what is wrong'
<b>Persistence with Awareness</b>	Persistence is continued or prolonged conscious efforts, or endurance towards a course of action in spite of difficulty and opposition. Opposition and discouragement will come in forms of inner contradictions and cognitive dissonance, thereby creating a sense of uncertainty, lack of confidence, confusion, and depression (Williams, 1999). To counter these inner contradictions, one must persist with a critical awareness of what is happening within the person and outside of the person. This brings about a greater resilience that the person may not have had before. This stage initiates the possibility of growth amidst crisis as the person attempts to answer the question 'why is this happening?' Persistence is related to the psychological concepts of resilience and mental/emotional hardness. Hardness is a combination of attitudes that provides the courage and motivation to do the hard work involved in turning stressful situations in to growth opportunities. Awareness during this stage allows for new wisdom and knowledge, through curiosity, creativity, open-mindedness, and a hunger for learning.
<b>Character</b>	Character is a combination of qualities, morals and ethics that distinguishes one person, group, or entity from

	another. Growth is seen as building character and strengths that define character such as cognitive strengths, civic strengths, strengths that protect one from excess (temperance), emotional strengths, interpersonal strengths, and spiritual strengths (Peterson and Seligman, 2004). Character is built through a series of actions one commits to follow, such as accepting reality, exploring new opportunities/options, testing new ground, and reconstructing one's own world view. If this is not attempted with total commitment and awareness, one could end up quitting or completely letting go, or even extending the inner crisis or only partially recovering from it (Williams, 2010). One of the most important questions to address at this stage would be, 'how can I change the situation?'
<b>Growth</b>	Positive change leading to maturity. This could be in physical, mental, emotional, social, and spiritual capacity. Perhaps there is a cultural element involved in supporting and encouraging people to make the shift. Closely-knit families, organizations, and communities can foster and aid people struggling for growth on the growth curve.
<b>Character Strength</b>	A distinguishable quality that overall contributes to character.
<b>New Perspective of Hope</b>	A positive outlook which may or may not result from a change of circumstances. Perspective is synonymous to wisdom that makes one see the same struggle differently. One may also come to appreciate the struggle that has now enlarged one's ability to endure in future crisis. One may draw lessons from the crisis experience, and validate their own theories about life.
<b>New Equilibrium</b>	A new state of balance, or a condition of a system in which all competing influences are balanced. In this new status quo, the person/community will be better equipped to face a crisis the next time around.
<b>Definitions of Negative Growth or Partial Growth</b>	
<b>Quitting</b>	Decisions to stop, cease, or discontinue trying, or forging forward, in the face of crisis. One might choose this stage out of tiredness of persevering and in the absence of any desired results. Quitting can push one towards feelings of hopelessness, disorientation, depersonalisation, and/or complete withdrawal.
<b>Extended Crisis</b>	This stage results in addressing the crisis over and over again with no clear results, no changes, and no growth. One might continue to go round and round in circles only to come back to where he/she started. This might result in chronic tiredness, apathy and bitterness.
<b>Partial Recovery</b>	One may only partly recover and may experience bouts of confusion, anger, and even depression.

### III. PROPOSED METHODOLOGY

To validate the above C<sub>2</sub>C Model of Change, a mixed methodology is recommended. Cohorts representing various demographic sectors will be interviewed about the most impactful crisis they experienced within a specific time period. Data on simultaneous crises experienced, if any, will be recorded as well. Qualitative data will be collected using semi-structured interviews and analysed using methods of interpretive phenomenological analysis

(IPA). Quantitative data will be collected using a series of validated questionnaires and surveys and results will be analysed accordingly.

Upon validation of the model with one cohort, further analyses will be carried out with various target populations and the results drawn will be compared across socio-demographic strata.

### IV. APPLICATIONS

The C<sub>2</sub>C Model was developed based on numerous counselling and coaching experiences and observations during focus groups and training of individuals, as well as organizations. The model can be applied at two levels – at the level of an individual and at an organizational (institutional) level – to understand the process of adaptation following a crisis. The data collected based on the model will enable practitioners to provide empirically driven and customized change management and coaching solutions to persons. The data derived from the model can also be used in designing resiliency-training models.

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# Unique Selling Propositions of MICE Tourism for Sri Lanka - A Conceptual view

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**Abstract**—MICE, although represents Meetings, Incentives, Conferences, Exhibitions and Events has become a fashionable work with the emphasis made by both Government tourism Authorities and Tourism Industry members and yet Sri Lanka has been lagging behind giants like Singapore, Malaysia and Thailand. It is common acceptance that MICE tourists spend three times over leisure traveler and there is gamut of benefits from MICE tourism special the spin off benefits such as promotion of trade, investment and indirect employment.

This paper identifies the basic issues in developing the MICE industry in Sri Lanka, which includes recognizing the terminology 'MICE' and identifying different strategies for each component of MICE. In the light of that Sri Lanka needs to identify the Unique Selling Propositions (USPs) in MICE in each component prior to developing a product market strategy. The paper also describes strengths and weaknesses in each area and recommends the approach that needs to be taken jointly by the Government through tourism authorities, industry members, Sri Lanka Airlines, and other stakeholders of the MICE industry.

It is necessary that Sri Lanka differentiate herself from the competitors by using the USPs especially for meetings and Incentives while conference requires changing of present strategy altogether thus shifting responsibility equally between the Government and Industry.

**Keywords**—unique selling propositions, MICE incentives, tourism categories, tourism industry

## I. INTRODUCTION

International tourism movements take us back to the Olympian days where travelers from various parts have been reported to have attended. In Sri Lanka Tourism began in the 50s with Boat tourists and expanded in the 60s mainly for beaches. Tourists visited as far as from Scandinavia in charter flights. Sri Lanka was way ahead of her competitors today namely Thailand, Malaysia, Singapore and India. Except for the period in which Sri Lanka was experiencing<sup>1</sup> internal strife for nearly 3 decades. Tourism took off after the war ended in 2009 recording arrivals from mere 500,000 to over 2,100,000 by the end of 2017.

When the destinations started competing with each other for a market share from the same tourist generating markets, tourism became fragmented into various categories mainly due to the need for destinations and industries to identify the predominant reasons when undertaking travel. Among the popular categories of tourism are Agro-tourism, Cruise Tourism, Wildlife tourism, Cultural tourism, Extreme

/Adventure tourism, Cultural and Heritage tourism, LGBT tourism, Medical tourism, Spiritual Tourism, Dark TOURISM etc.

International Tourism has grown at a rate of around 4% over the last decade and according to According to<sup>2</sup> UNWTO as announced by their press release 26 June 2018 - International tourist arrivals grew 6% in the first four months of 2018, compared to the same period last year, not only continuing the strong 2017 trend, but exceeding UNWTO's forecast for 2018. International tourism continues to show significant growth worldwide, and this translates into job creation in many economies. This growth reminds us of the need to increase our capacity to develop and manage tourism in a sustainable way, building smart destinations and making the most of technology and innovation", said UNWTO Secretary-General, Zurab Pololikashvili (UNWTO, 2018).

Therefore the growth of tourism has been unquestionable in the last decade as well as the future in view of the increasing spending power of some communities especially in China and India. The growth in South Asia has been over 9% and this would be a good indication for Sri Lanka too as it reflects the movement of the traffic in the region. The International traffic moving into South Asia specially Sri Lanka and India has been phenomenal and both countries offer similar attractions namely Beaches, Ancient Cities, Wild Life, Culture and Heritage and Scenic Beauty. Sri Lanka has differentiated herself by using the pillar 'Compactness' thus detaching from India in Marketing and Promotion.

## II. BACKGROUND

Since the 70s, MICE tourism has taken a front seat due to many advantages in MICE tourism. Lungile Zulu explained in 2016 that MICE is Meetings, incentives, conferences, and exhibitions, or Meetings, Incentives, Conferences, and Events (MICE) is a type of tourism in which large groups, usually planned well in advance, are brought together for a particular purpose. Zulu further explains the definitions for Meetings as a general term indicating the coming together of a number of people in one place, to confer or carry out a particular activity and Incentive as an event as part of a programme which is offered to its participants to reward a previous performance, Conference as a participatory meeting designed for

<sup>2</sup> UNWTO is the United Nations Organisation established for the Development of International Tourism

<sup>3</sup> MICE Stands for Meetings Incentive Travel Conferences and Exhibitions

<sup>1</sup> Conflict that last nearly 26 years affecting security of the country



discussion, fact-finding, problem solving and consultation. As compared with a congress, a conference is normally smaller in scale and more select in character – features which tend to facilitate the exchange of information. (The planner.Guru, 2018)

The term “conference” carries no special connotation as to frequency. Though not inherently limited in time, conferences are usually of limited duration with specific objectives. Exhibition – Events at which products and services are displayed. There has been an industry trend towards using the term ‘meetings industry’ to avoid confusion from the acronym. On the otherhand industry educators are recommending the use of “events industry” to be an umbrella term for the vast scope of the meeting and events profession (ibid).

According Zulu there has been an industry driven initiative to use the Meetings Industry instead of MICE market in order to give its due place as MICE is not really an extension of Tourism and rather it is the other way around. The meetings industry in some of the developed countries is so huge and this reflects in the size of convention centers they built over the last 2 decades. It appears that countries that considered MICE as a separate industry has moved forward to benefit from all elements of MICE while countries that depended heavily on leisure had problems in moving into MICE later and this includes Sri Lanka.

General Tourism can have limitations in income levels as exclusive upscale visitors to Sri Lanka in any event are not as big as package travelers. There are boutique properties in Sri Lanka that need to be promoted while bearing in mind that the market is limited as Sri Lanka’s profile is not yet lifted up to images of certain other destinations such as Singapore.

‘Value against the numbers’ is the reason that many countries turned to MICE tourism. Singapore and Malaysia, our closest examples, never looked back in their focus on MICE development since 80s and Sri Lanka was over relying on leisure with lucrative business coming from Europe and Scandinavia. Apart from that, the infrastructure did not develop on par with the giants due to the conflict. Time has now come to re think the tourism strategy in more practical sense.

Around 9 percent of the total visitors into Sri Lanka represent the MICE segment. MICE tourist is an up market visitor who spends three-four times over average holiday maker. MICE industry involves many support services generating considerable amount of direct and indirect employment and MICE travel encourages repeat holiday visits and other trade and investment transactions, not necessarily relevant to tourism.

This explains the level of state involvement in the development of the MICE sector in countries like Singapore, and Malaysia way before they launched tourism campaigns' Uniquely Singapore; and Malaysia truly Asia'. True enough, the conflict in Sri Lanka prevented the infrastructure development that MICE industry calls for to meet international standards of events.

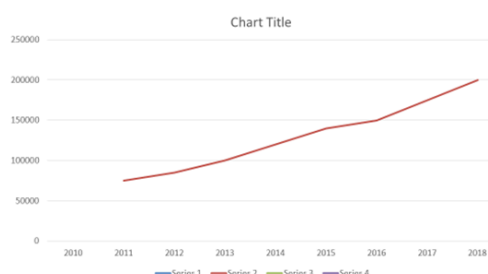
Positioning Sri Lanka internationally as a recognized venue for 'Meetings' requires a different approach unlike the branding of countries for general tourism. Here the customers are associations, institutions, executive committees, corporate. Country's image does matter for

higher delegate attendance but again the opinion leaders will do the needful if the communication methods and modes are right.

Having research data on MICE is a global problem although Singapore and Australia have successfully adapted satellite accounting system to ascertain MICE statistics and their true benefits. The promotions in India with Sri-Lankan Airlines have generated immediate business and the industry now says 'Sky is the limit' from the Indian market bearing in mind that the Indian market is price sensitive.

The reason is obvious with long haul travel being affected by the economic set back and Sri Lanka's profile, proximity, value and diversity cannot be matched by other competitors, if conveyed to Indian Corporate and Travel agents effectively particularly the small segments such as board meetings, planning sessions.

### MICE Statistics – Sri Lanka



### The Importance of MICE

Sri Lanka was eagerly awaiting the completion of Hambantota Convention centre and Nelum Pokuna but they eventually became auditoriums thus losing the multipurpose opportunity.

The benefits of MICE over leisure tourism can be summarized as follows (Exlink Events, 2012)

- High Spending 2-3 Times over – High Yield
- Brings in quality tourists
- Stimulate infrastructure Development
- Tendency to generate repeat holidays
- Generates trade and investment activities
- Extended length of Stay
- Increased Tax Revenue
- High level Support Services that draw more direct and indirect employment
- Direct contribution to Image building
- Develops business and industry relationships

Apart from these, there are other qualitative Benefits of MICE such as Combating Negative Image, Enhance profile of the destination, Boosting efforts of repositioning the destination or location, Improve quality of life of those who are involved in MICE and promotion of lesser-known attractions

The industry or the beneficiaries are state as follows:

- Primary Industry – Airlines, Hotels, Transporters, Venues, PCO, PEO, DMCs, Event Management Companies
- Secondary Beneficiaries – Freight forwarders, Exhibitors, Restaurants, Entertainers, Tour Agents, Shopping Centers, Souvenir Shops, Banks, Communication Centers, Advertisers, Caterers, Printer, Multi Media suppliers, Sounds and Lights

This establishes that MICE Tourism extends benefits to many across the board with much indirect employment.

It was stated that MICE is a separate industry and it is not an extension of tourism. The reason being that MICE industry consists of players outside the usual industry members in tour operations. The only connection may be the link between incentive operators and inbound tour operators as in Sri Lanka these are one companies. Unlike Germany Sri Lanka does not have exclusive Incentive operators.

For instance, the MICE buyers can be Associations, Institutions, Corporate, Meetings Planners, Incentive Houses, Event Organizers, Sports Bodies and Franchise holders.

### III. LITRETURE REVIEW

The term tourism is briefed by Kreag (2001) as an activity of visitors traveling outside their usual destination for less than a year for several purposes such as for Leisure, holiday recreation, business or personal matters, social influences, religious activities, education, health and medical, Shopping and many more. Out of all the purposes, Business travel takes up a special place in terms of MICE Tourism (Koth et al. 1995). The travel acronym MICE stands for Meetings, Incentives, Conferences and Exhibitions that involves people coming together at one place for a common purpose of a short period of time (Stefan and Conny, 2009).

Even though there is a wide range of literature available on MICE tourism in other primary destinations, there is limited research published on MICE with reference to Sri-Lanka. According to JL Lee (2016) MICE is not just one industry it is a service industry that operates with association of transportation, accommodation, trade, finance and travel.

Khan (2015) addresses MICE tourism as a perfect method of merging business with pleasure. Moreover he further states that MICE provides Unique opportunities for a Nation's Economic development because Meetings, Incentives, Conferences and Exhibitions are now extensively growing in association with travel for business purposes.

According to various reflections from existing researches in the world MICE industry carries a huge importance to a Country though its multiplier effect for nation's economic development. Dhamija (2013) highlights the fact that MICE businesses hold an enormous potential for a country's economic welfare. The article of Khan (2015) estimated that a MICE traveler spends 4-8 times higher than a leisure traveler. In 2005, Las Vegas earned 24.5 billion US dollars from 38.5 million tourists. 16% of them were attracted for MICE purposes driving 7.6 billion USD economic incentives towards the country (Leong, 2007).

Dhamija (2013) greatly highlighted the fact that MICE industry needs huge infrastructural developments. Xinli Xie & Qunchao Lu ( 2006) further added the need of host destinations of MICE to posses modernized venues, latest information technologies, well located transport systems and networks, managed traffics, star classified accommodations, attractions with urban beauty etc.

Leong (2007) further highlighted entertainment as a driving factor to MICE destinations. This mainly drives incentive tourism that is conducted purely for relaxation and entertainment as a reward for the jobs well done (Khan, 2015).

His statement can be proved by the fact reported by Singapore Tourism Board (1991) cited in Colston (2016) stating the enhancement of MICE industry Singapore by 7.8% due to the establishment of sightseeing attractions, dining and shopping centers that provides a perfect complement for MICE experience. Furthermore, After 45 years of Entertainment and MICE developments Las Vegas is now labeled as "The World MICE City", it is the most successful and most sophisticated MICE destination in the World (Leong, 2007). Briggs (2001) addresses these as Unique Selling Points (USPs). For instance, BCVB (2005) cited in Leong (2007) identifies 1500 rooms' accommodation, 280 weekly flights 150 restaurants and Pubs and MICE infrastructure as the USPs of MICE tourism in Bulgaria.

Frederic Barding the Vice President of Arabian Adventures and Congress Solutions Dubai during an interview stated that their objective is to make Dubai a leading MICE destination in the World. For that their plans is to perfectly position Dubai to attract MICE travelers from US, Europe and Asia. He further states "We can get 40,000 to 45,000 people in to Dubai within three days for mega events" (Asia pacific MICE magazine, 2008).

Moreover, according to the MICE in Asia Magaine (2008) cited in Damija (2013) Indian economy started its reconciliation by stepping into MICE Tourism. Its economy flourished with the upgrade of world-class MICE facilities. For instance facilities such as Vigyan Bhawan in New Delhi, the Jaypee Hotels & International Convention Centre, Renaissance Hotel and Convention Centre in Mumbai, Agra and the Cochin Convention Centre, Centre Point, the BM Birla Science and Technology Centre in Jaipur Kochi etc are USPs of MICE Tourism for India (Khan, 2015).

"MICE is the buzzword for tourism development today" Khan (2015). MICE have become a trending tourism type that every nation is trying to develop because now the world has recognized the benefit of MICE in all aspects. Khan (2015) further noted that the MICE touristic activities generate more revenue with lesser impacts than ordinary tourism for the host destination. Thence, every country is now exerting their full efforts to position themselves as MICE destinations by giving the business travelers the best.

#### IV. RESERCH DESIGN & METHODOLOGY

This is a conceptual paper, which takes into consideration the available data, and analysis of the situation rather than statistics. For instance it is known that getting MICE data is extremely difficult because many MICE travelers declare themselves as tourists at the time of travelling in order to avoid the hassle of getting business visa etc.

In this study the salient features of the available positions will be analyzed in the context of Sri Lanka Political, Economic, Social, Technology, Legal and Cultural sphere as well as the micro environment such as capacity of event handlers, intermediaries etc.

What would be brought out by this study will be obvious reasons to choose the USPs when promoting MICE tourism for Sri Lanka. The analysis would be based on the following questions.

- i. Understanding overall micro and macro factors that will have direct impact on MICE Tourism markets,
- ii. Apply Principles of Marketing including Research, Segmentation, Profiling, Targeting, Positioning, Branding etc.
- iii. Assess requirements for Product Development standards of services and value additions
- iv. Collection of Data and following up business leads
- v. Provision of required training for MICE

The analysis will be done according to the terminology of MICE namely Meetings, Incentive Travel, Conferences, Exhibitions and Events based on available data as to the current position in Sri Lanka (The Sunday times, 2017).

#### V. ANALYSIS OF POSITIONS AND BACKGROUND

##### i. Meetings

The meetings market in MICE can only emerge from India for the moment although there is some potential from the Middle East, and the Far East. The meetings can be Regular Meetings, Ad Hoc Meetings, Seminars, Workshops, Board Meetings, Brain Storming sessions, planning sessions, AGMs, Shareholder Meetings etc.

It was reported that nearly 1.1 million Indian travels abroad for meetings and their current destinations are Bangkok, Kuala Lumpur, Hongkong, Bali, Macao and Sri Lanka. The numbers from Indian market coming for meetings is less than 15,000 according to SLCB statistics.

Tapping the Indian meetings market is desirable and the question here is how to approach the Indian Corporates and the Meeting planners. Sri Lanka needs to adapt her own strategy. Sri Lanka has already attracted Indian Corporates such as Sony Erickson, WIPRO, Virtusa, Titan, BOSCH, , Microsoft, Coca Cola, TVS, Johnsen and Johnsen, Nestle, Nokia, General Electric , Pepsicola, Reckitt Benckiser, Samsung, Amway, and many others in 2010 and 2011. These efforts needs to be strengthened by having special joint promotions targeted to Indian Corporate and Meetings planners

##### ii. Incentives

Sri Lanka needs to adapt her own strategy by capitalizing Sri Lanka's diverse locations by reinforcing among Incentive Houses in Europe where the biggest market exists

for Sri Lanka such as France. The approach for meetings in India could encompass Incentives from that part of the world. The strategy should also involve creating programs to give 'wow' factors to incentive travelers in itineraries. Participate in Incentive fairs and organize road shows to reach out to Incentive houses in Europe.

##### iii. Conferences

Sri Lanka is lagging behind in the conference market in view of the inability of entering the bidding processes. It is necessary that Authorities expand the SLCB (Sri Lanka Convention Bureau) to offer more assistance to PCOs (Professional Conference Organizers) using ICCA (International Congress and Convention Association) data based. Currently only SLCB is having a membership with ICCA. Establish close relationship with professional Associations who could bring conferences into Sri Lanka after bidding process.

##### iv. Exhibitions

In the Exhibition sector, apart from the regular exhibitions, Sri Lanka has attracted Textech, Indian Trade Fairs, Jaffna International Trade Fair, and Power Sri Lanka 2010 Etc. However Sri Lanka's Exhibition space is almost full and the exiting capacity does not allow Sri Lanka to expand the Exhibition business. SBECC, SLECC are the known convention centers for Exhibitions while the other convention halls are mere auditoriums.

##### v. Events

There are many event categories; local, regional and international events. The benefits of staging them need to be based on following criteria.

- Direct and indirect income generated by the event
- Level Of Publicity that the location or destination gets – (Solo performance of Sonu Nigam and Shreya Goshal)
- The extent of enhancement of the brand image (IFFA, Trick show Rally)
- Linkages to other activates (Presence of Phillip Kotler)
- Government support needs to be extended through institutions such as BOI, SLCB, EDB, and Tea Board for relevant events.
- Extension of support to local event managers to develop the business (tax rebates)

#### VI. RECOMMENDATIONS & CONCLUSION

Deploy specific MICE research to ascertain market potential and buyer behavior

Treat MICE as a separate Industry without considering it as an extension of Tourism

Each component of M.I.C.E requires different approach in the development and promotion. It is not just one word and one strategy. Use the recommendations given when developing separate strategies

Use Satellite Accounting system to ascertain real benefits of MICE

2018 International Conference On Business Innovation (ICOB), 25-26 August 2018, NSBM, Colombo, Sri Lanka

Initiate establishing a multipurpose Convention Centre with Convertible facilities similar to Hyderabad and Singexpo Convention Centers.

Understand the visitor profile better in all MICE components

Link MICE to other economic activities specially Trade and Investment

Positioning Sri Lanka in each market developing and projecting competitive advantages

Joint promotions with the Sri Lankan Airlines and its Members for synergy

Encourage and motivate local associations, NGO, diplomatic missions and corporate sector to secure MICE activities in Sri Lanka

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# Coaching for Excellence: A Case Study in Growing Leaders with a *People Development Mindset*

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**Abstract**—The paper is an evaluation of a coaching training initiative at a technology organization, as means of developing “people development” competency within the leaders. Organizations in which leaders adopt coaching. The coach training initiative presented in this paper was based on the P3 GROWTHS Model, a coaching model for developing transformational leaders. The presently evaluated program utilized intensive workshops and supervised paper coaching sessions to develop key skills; skills were assessed at various points, and findings indicated a positive improvement in skill indicating effectiveness of the program. The findings have positive implications for the use of the P3 GROWTHS Model in developing leaders inclined for people development.

**Keywords**—coaching, coach training, people development, training and development, leadership

## I. INTRODUCTION

Leaders are defined in many ways, from being the individual responsible for determining organizational strategy to ensuring achievement of organizational objectives. Both these definitions, which are accurate, require a leader to be highly skilled in managing and working with people. In strategizing and ensuring the achievement of these strategy, a leader is given the responsibility of aligning people, motivating people, inspiring them, and mobilizing them effectively to perform [1]. As defined by Scholtes [2] a leader must be able to understand the people in their organizations – their behavior, their motives, how they learn, and use this knowledge to bring about true improvement and change within them. More recently, John Maxwell defined ‘people development’ as the fourth of his five levels of leadership, emphasizing the importance of investing time into nurturing and developing people to build capacity in taking the organizations’ missions forward.

Unsurprisingly, in the countless programs and curricula that have been dedicated to developing leadership, the aspect of “people development” is a core and crucial emphasis area. A specific skill that is often the focus of these programs is coaching. Coaching is defined as a partnership with a client towards a process that helps maximize their personal and professional development [3]. Coaching is a form of developmental conversation which uses questions and techniques to draw out solutions from a client to achieve specific, client-defined goals. It is non-prescriptive in nature, such that it does not include training or advice. Of all forms of people development initiatives, coaching from one’s direct manager has been identified as the most effective method in developing staff across the organizational hierarchy [4]. Workplace coaching has been effective in reducing work related stress in employees [5]. Additionally, it has been found to improve levels of goal attainment, improve overall

workplace wellbeing, increase personal insightfulness, support management skill development, and help individuals manage change [6]. In that light, offering Coach Training to leaders in the organization in efforts to improve their overall leadership effectiveness appears promising.

Wilson [7] describes the positive effects experienced by Richard Branson’s organization, when he adopted the coaching style as his management style. The article goes on to describe that when the coaching style was integrated as the company culture across the hierarchy, the organization itself was able to grow in its’ effectiveness. The study further summarizes the impact of training managers on coaching which led to, following some initial resistance, a positive change in department performance and morale – translating to a 30% increase in productivity and 20% reduction in resource utilization [7].

The present study is a case study analysis of a program towards developing the “People Management” competency as part of a broader leadership development initiative for the middle management of a leading technology company in Sri Lanka. The program used the P3 GROWTHS Model [8] a coaching model for leadership development, as the structural framework for the program.

The objective of the present case study analysis is to determine the effectiveness of using the P3 GROWTHS Model as a framework for coach training.

## II. METHOD

### A. Sample

A total of 34 participants took part in the program initiative. The participants were middle managers from a leading technology organization in Sri Lanka. The selection of participants was conducted by the Human Resources department of the organization, and the research team had no influence in sample selection.

The sample was heterogeneous in relation to gender, age, and job role. Certain participants hailed from technical roles, whereas others were from people-oriented roles.

### B. Program Design and Delivery

- Program Conceptual Framework

The P3 GROWTHS Model (Figure 01) is a coaching model that prescribes a process for growing in transformational leadership. The model was developed based on three principles of growth that are often seen in nature; Presence – the rooting/grounding stage, Purpose – the shaping of direction, and Partnerships – the forming of connections and links to generate action (the three stages

have been likened to the growth of trees and human embryos). The idea that growth occurs intrapersonally (I), interpersonally (YOU) and as a community (WE) was inspired by the Development Beyond Learning publication “Graduates’ Edge” which prescribes a model for developing leadership qualities in graduates [9].

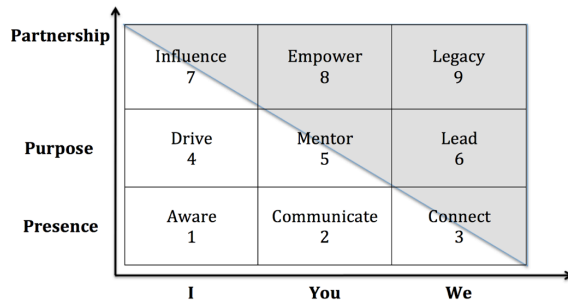


Fig. 1. The P3 GROWTHS Model (Silva, 2012)

Brief definitions for each stage in the above model are provided below;

1. Aware – Creating personal presence through an increased understanding of one’s self; strengths, weaknesses, beliefs, values and perceptions.
2. Communicate – Process of creating presence with another by understanding the other person with no bias and judgment.
3. Connect – Extending presence to a group/community, where one integrates with the group in an authentic manner and builds relationships of trust.
4. Drive – Being personally driven to a clear life purpose that aligns with one’s values and self, that provides intrinsic motivation to engage in one’s work.
5. Mentor – Process of bringing another person to their purpose and supporting them in that direction without being hindered by personal agendas.
6. Lead – Uniting a group/community to a unified purpose such that all members are aligned and working towards it.
7. Influence – Ability to be a voice to the larger community to draw influence to the cause of one’s purpose.
8. Empower – Forming a partnership with another to resource and energize them towards achieving their purpose, for no personal benefit.
9. Legacy - Partnership with a community with a purpose of long-term impacting the community that can be enjoyed by future generations.

#### • Program Design

The Coach Training program was mainly based on the first five stages of the model, as they are most relevant to the Coaching Conversation. Core coaching competencies defined by the International Coach Federation were mapped onto the relevant five stages [10]. The following core coaching competencies were mapped:

- 1) Creating Presence
- 2) Sets Purpose
- 3) Powerful Listening
- 4) Powerful Questions
- 5) Reframing Perspectives
- 6) Creating Awareness
- 7) Teaching Moment
- 8) Taking Action
- 9) Summarizing

The above competencies were first developed through a two-day intensive workshop series. They were subsequently further developed in three supervised peer coaching sessions, in which the participants worked in groups of three. These sessions provided an opportunity to practice the coaching skill, and receive feedback from a supervisor coach, the coachee, and one’s peers.

#### C. Assessments and Data Collection

Data was collected at various points during the assessment. The source of data that is considered in this study was collected during the supervised peer coaching sessions.

A structured evaluation form was designed to assess the coaching competencies defined in the previous section. Supervisor coaches were briefed on the evaluation form and on the rating scale.

A five-point Likert scale was used to rate the behavioral indicators for the coaching competencies; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

At each session, each individual participant was assessed in a 360o manner; by self, by a peer, and by the supervisor. To ensure the reliability of analyses, only supervisor assessments have been used in this research.

The collected data was entered and saved for the three subsequent sessions, for subsequent analysis.

#### D. Analysis

Following the collection of all data, average batch competency ratings were calculated for each of the three practice sessions to understand the progression of competency across the training period.

A comparison of means analysis was conducted using the data from the first practice session and the final practice session data to assess whether a significant change in coaching competency was observed.

### III. RESULTS

#### A. Average Coaching Competency Progression

The below graph (Figure 02) presents the sample’s average progression in coaching competency throughout the three supervised peer coaching sessions. Error bars are indicated in the figure.

The sample averages indicate improvement in all the nine coaching techniques from Session 01 through 03, indicating that a steady improvement in coaching technique has occurred in the entire participating sample.

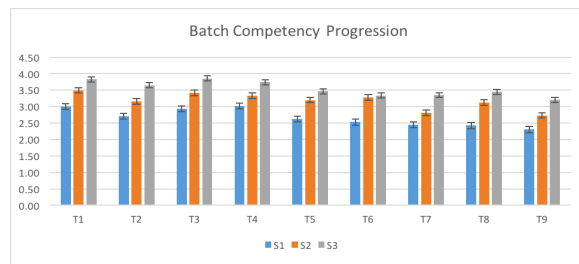


Fig. 2. Batch Competency Progression

T1: Creating Presence	T6: Creating Awareness
T2: Sets Purpose	T7: Teaching Moment
T3: Powerful Listening	T8: Taking Action
T4: Powerful Questions	T9: Summary
T5: Reframing Perspectives	

### B. Significance of Change

Using the sample's average competency scores for session 01 and session 03, the percentage improvement in competency scores was calculated for each coaching competency, and is represented graphically below. Error bars are indicated in the figure.

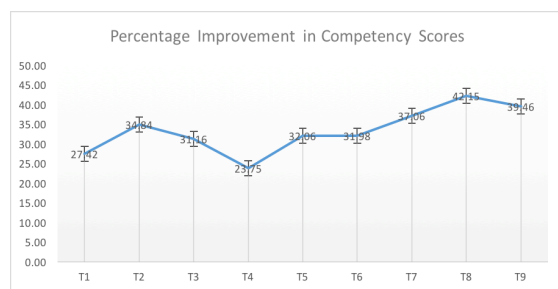


Fig. 3. Percentage Improvement in Competency Scores

T1: Creating Presence	T6: Creating Awareness
T2: Sets Purpose	T7: Teaching Moment
T3: Powerful Listening	T8: Taking Action
T4: Powerful Questions	T9: Summary
T5: Reframing Perspectives	

A t-test was carried out to assess whether a significant change was present between the scores at the first session, and the final session. The results indicated a significant difference between the sets of scores,  $T=27.69$ ,  $p<0.05$ . This indicates that the program had been effective in bringing about a significant change in coaching competency for the sample, suggesting that the P3 GROWTHS Model is an appropriate methodological framework for developing people development competency in leaders.

## IV. DISCUSSION OF FINDINGS

The findings of the study present positive implications for the use of the P3 GROWTHS Model in developing the "People Development" aspect of leadership. The model had previously been cited as effective in developing leadership related competencies in Engineering

undergraduate students [11]. Given the model's grounding in coaching methodology, it is encouraging to note its effectiveness in a coach training setting.

In reflecting on the aspects of the program that may have led to its effectiveness, the program methodology and delivery methods are considered. Firstly, the coaching methodology, which draws out solutions for one's own professional development from the self, has been recommended in literature for encouraging long-term learning. Thereby the mode of delivery, which was focused on activities and self-directed learning would enhance the effectiveness of program content [12]. The use of role-plays in training leaders has been noted as effective in developing various skills in leaders, including interpersonal skills [13].

Further, the content emphases in the program are in line with recommendations in previous research. A study by McCarthy & Milner [14] highlighted the importance of emphasizing different coaching *skills*, rather than merely presenting a basic coaching process to be adhered to. This emphasis of skill building is a key characteristic of the presently evaluated study. Furthermore, basing the coach training on the P3 GROWTHS Model led to including intrapersonal oriented skills such as developing holistic personal awareness and reflectiveness. This was a key recommendation in Ladyshwesky [15], who highlighted the importance of a manager's understanding of their personal perspectives, values, and overall emotional intelligence in order to be effective in coaching their staff. The importance of supervised opportunities for practice, which the present intervention delivered through the peer-coaching sessions, has also been emphasized in McCarthy & Milner [14].

A limitation in the present study is the inability to control for the other conditions the participants were exposed to. As the coach training intervention was delivered in an uncontrolled setting, where the research team had little control over the alternate experiences and factors the participants were exposed, it must be acknowledged that the significant improvements that have occurred related to level of coaching competency could also have possibly been due to other confounding factors. Participants' varying levels of previous experience in interpersonal skills training could have led to different learning trajectories within the group. Further, the opportunities to integrate the learned coaching skills into practice might have varied across different participants in the group – based on the nature of their work, or the response of the team members. Thereby, the individual trajectories of developing coaching skills within the sample may have been widely different. Moreover, the participants were at different life stages, and brought in different levels of maturity to their coaching skill development journey. Furthermore, individual differences in the participants' openness to learning new concepts, and changing their style of leadership could have also mediated their coaching skills development. Circumstances in life at any given time may also have influenced different participants' level of engagement and involvement in this program – thus impacting the learning and skill development.

Furthermore, the reliability of the assessments themselves needs to be considered. A panel of three supervisor coaches conducted the coaching skills

assessments, and individual differences in assessing could have introduced some bias to the assessment process. However, all three supervisors were extensively trained in assessments using the model to minimize any such biases. Further efforts were made to minimize such effects by way of a supervisor deliberation on the final scores, which was conducted prior to the analysis.

In a practical sense, the present paper presents positive implications for the use of the P3 GROWTHS Model for developing the aspect of people development in leaders. Future research can add value by using a more empirical design, using control groups and random assignment to be able to better gauge the usefulness of the P3 GROWTHS Model in developing people development competency.

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# Governing Environmental Sustainability: A Literature Review

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**Abstract** — Environmental sustainability is the most important global challenge. All governments in the world are recommended to address this challenge by using digital technologies and their applications. Scientific evidence has shown that human behaviors contribute significantly to the deterioration of the natural environment. Therefore, this is crucial that governments can exploit the benefits of digital technologies to engage their citizens to handle/govern environmental sustainability. In this paper, we conduct a systematic literature review and aim to deepen our understanding of the interrelationships between e-government, citizen participation, and environmental sustainability. The results show that the research that explores this crucial interrelationship is surprisingly rare. Therefore, more future study is called for contributing more knowledge towards this research focus.

**Keywords**— digital government, environmental sustainability, citizen participation, literature review

## I. INTRODUCTION

Sustainable development is one of the globally accepted phenomena and its top prioritized needs of almost all the nations. The environmental sustainability cannot be achieved alone and it's always bundled with the social, economic sustainability and collective action between government and citizens[1][2]. With the advancement of Information Communication technology and Digital connectivity, almost all the governments in countries focus more on providing Digital government and Digital government based services with the aim of engaging citizens in the process of decision making and governance [1][3]. Engaged citizens create the opportunity to harness collective intelligence within the public sector, which could generate greater value from government initiatives[4]. The way to get citizens engaged is for governments to become more open, i.e. transparent, participative, collaborative [4] and also through e-government services, which make integrating a citizen's own resources (e.g. environmental knowledge, IT-skills, and access) with resources provided by the government, for example a website, feasible[5]. E-government services within this context are thus an enabler and an arena for co-creation by allowing greater utilization of resources than traditional government would engage in [5].

Citizens are more vigilant than ever in achieving environmental sustainability. Researcher attempts to develop theories, methods and tools aid for e-government services in addressing environmental sustainability issues [1]. Therefore, this is of great important that governments can improve/design e-government Services for citizen participation in governing Environmental Sustainability. This

paper conducted a systematic literature review in order to obtain the comprehensive understanding of the state of art research regarding this research focus.

A systematic literature review was conducted based the articles found in the database Web of Science. The results from the review indicate that:

1. The research carried out to explore the interrelationship between E-government, Citizen Participation and Environmental sustainability is supervising very rare.
2. Citizens are increasing involved and engage in achieving environmental sustainability. Environmental issues can be potentially solved using collaborative approaches through E-participation.
3. Although e-government/ online platform services and ICT tools could offer to the public for citizen participation in governing environmental sustainability, governments seem not to prioritize such e-government initiatives in comparison with those for social and economic sustainability.

## II. CONCEPTUAL FRAMEWORK

### A. E-government

The E-government or Digital government is a multifaceted concept and it has been defined in different ways in different sources. The World Bank [6] has defined E-government as "Government-owned or operated systems of information and communications technologies (ICTs) that transform relations with citizens, the private sector and/or other government agencies so as to promote citizen empowerment, improve service delivery, strengthen accountability, increase transparency or improve government efficiency".

There are number of advantages of using Digital government services. Major advantages can be listed as 1. More efficient government, 2. Better services to citizens, and 3. Improved democratic processes [7]. A majority of the governments offer e-services for their citizens and already systems are in place to offer general services to the public. However the implementation and adoption has been a challenge in both developed and developing countries [8]. In addition to implementation and adoption challenges "Digital divide" is another fact which affect the Digital government. The term mostly refers to the gap exist in access and use of Information and Communications Technology (ICT) devices [9]. Hence, governments need to take necessary measures to improve Information Communication Technology (ICT) literacy, policy decisions and infrastructure development for accessibility of services for the general public.

### B. Environmental Sustainability

Out of three major pillars of Sustainable Development, the Environmental Sustainability has become one of the main pillar of organizations and societies. Environmental Sustainability is defined as “Stakeholder behavior impacting on the natural environment that meets the needs of the present without compromising the ability of future stakeholders to meet their own needs” [10]. By the World Commission on Environment and Development defined the term as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [11].

The paper ‘Current Opinion in Environmental Sustainability’ has reviewed and synthesized research on sustainability and environmental change explicitly focuses on environmental sustainability [12] based on 6 focus areas as 1. Climate systems (covering climate and climate change, climate risk management, mitigation and adaptation). 2. Human settlements and habitats (covering cities, urbanization and transport). 3. Energy systems (covering energy use, energy conservation, renewable energy, energy efficiency and bioenergy). 4. Terrestrial systems (covering natural and managed ecosystems, forestry, food systems, biodiversity and ecosystem services). 5. Carbon and nitrogen cycles (covering sources and sinks, feedback processes and links to other systems). 6. Aquatic systems (covering marine and freshwater ecosystems, fisheries, currents and biodiversity)[13].

### C. Citizen Participation

The main and ultimate goal of the e-government is to be able to offer an increased array of public services to citizens in an efficient and cost effective manner to make their tasks easy and effective. Through this transparency of the government policies, procedures, future strategies will be communicated and visible among everyone. This E-participation provide number of advantages such as reduce overall administration costs, improve efficiency, make people ease of use and easy storage and retrieval of information and advantages of ease of information dissemination. This will allow government to listen for public opinion and public will get an opportunity raise their voice and be a part of decision making process. Each government can make use of citizens’ trends and preferences in using internet and ICT to offer e-government services, empower them with decision making process and improve participatory management.

The Citizen Participation, Citizen Science, Citizen Engagement and Crowdsourcing are similar terms used to allow the general community to work collaboratively and solve general issues. This is a productive emerging trend that could be used and applied for, to solve many real complex tasks with least resources. For an example, in urban planning process, we could use ‘Citizen Design Science’ as a new strategy for cities to integrate citizens’ ideas [14]. Citizen participation has applied in many form of the governance and traditional modes of decision-making has become increasingly challenged [15]. Presently a lot more researches are carried out with the concept of Citizen Science where scientists and volunteers work collaboratively to investigate various topics. During the recent past there is an increased interest on public participation in social,

scientific and other research disciplines. This growing trend of working together as scientists and citizens has mutual benefit for both parties. We could find a number of Citizen Science projects and the high visibility of Citizen Science activities in national and international including platforms such as Zooniverse, European Citizen Science Association and Australia Citizen Science Association etc.[16]

### D. Enabling ICT Technologies

The emerging effective ICT tools and technologies are used to automate many of the day to day operations and provide greater services to the public and governments. Latest development of big data, Internet of Things (IoT), wired and wireless networks, sensor technologies allows to create active design tools get the opportunity involve citizens in E-government services in addressing environmental sustainability. There are many real world solutions which are provided for our lives and society through Internet of Things (IoT) is a technology by integrating smart devices in our environment and paving the way for innovative ICT applications used in smart cities, energy efficiency and home automation [16]. Smart Cities has become a widely discussed phenomena with urban development and ICT technologies. Smart city could be applied as effective and efficient solution in six domains: smart economy, smart people, smart governance, smart mobility, smart environment and smart living. It can be further broaden and within the Smart environment we could find sustainable resource management, environmental protection, pollution and attractiveness of environmental conditions[17].

## III. METHODOLOGY

In this paper, we conducted a systematic literature review. A systematic review is an appraisal and synthesis of primary research papers using a rigorous and clearly documented methodology in both the search strategy and the selection of studies. This minimizes bias in the results. The clear documentation of the process and the decisions made allow the review to be reproduced and updated. In this approach, the state of the art research are systematically reviewed using inclusion, exclusion criteria and other parameters.

The literature was retrieved from international research databases Web of Science. The reason to choose this database is to ensure the review were based on relevant and high-impacted articles that published in academic journals across various disciplines.

In order to explore the interrelationship between e-government, citizen participation and environmental sustainability, the query further constructed in three categories as pair search. Categories can be summarized as follows;

- E-government and Environmental Sustainability
- Citizen Participation and Environmental Sustainability
- Citizen Participation and Environmental Sustainability and Citizen Participation

The results based on the pair search are further shortlisted through the inclusion and exclusion criteria.

#### A. Inclusion criteria

- Journal articles from all the disciplines related research with a primary focus on above three search categories.
- Studies published in the English Language.

#### B. Exclusion criteria

- The research is focused on environmental sustainability and research articles with a focus on general sustainability or social and economic sustainability are excluded.
- Papers are not 'Full Paper'.

The final results were stored in a Microsoft excel sheet for final analysis (Table I).162 results were generated by the three categories of search query pairs. It was reduced to 10 after a refined search with the inclusion and exclusion criteria. The filtered articles were re-examined using the abstract of the articles. The exact focus area is considered when we review through abstract of the articles. The articles which do not focus both of the terms specified in the pair search were excluded. In the end, ten papers were included in this review. The full text of the papers was carefully read to gain comprehensive understanding of the research question.

TABLE I. NUMBER OF SELECTED ARTICLES

Category	No. of articles
Citizen Participation and Environmental Sustainability	6
E-government and Environmental Sustainability	3
E-government and Environmental Sustainability and Citizen Participation	1

#### IV. RESULTS AND ANALYSIS

The results indicate at the research that explore the interrelationships between e-government, citizen participation and environmental sustainability is extremely rare. Digital technologies do support citizens to participate more and more in solving environmental issues. The state of the art e-governments services have the potential to engage citizens in achieving environmental sustainability. However, not many governments are prioritizing and pursuing e-government projects for achieving environmental sustainability in comparison to social and economic sustainability.

##### A. Citizen Participation AND Environmental Sustainability

Out of 6 papers reviewed under Citizen Participation in Environmental sustainability (Table II), 3 of the papers discussed the general Environment issues. Another 2 of them on Water issues and other research is based on Air/Water. The research was mostly conducted in developed countries (Europe, New Zealand, USA, Australia, and China) and all are based on qualitative studies, for instances, 3 of the researches used Case studies and other 3 is based on qualitative Survey. Observation, Interviews and questionnaire are the data collection methods applied in the research. One research has applied the Ladder of Citizen participation and commons theory [18].The "Ladder of citizen participation" that showed participation ranging from high to low. The ladder is a guide to seeing who has power when important decisions are being made.

TABLE II. ENVIRONMENTAL SUSTAINABILITY ASPECT VS. APPROACH OF CITIZEN PARTICIPATION.

Citation	Environmental Sustainability Aspect	Approach of Citizen Participation
Johannes,E. ;Sonja. H. (2017)[18]	Water	Active inclusion of the public in the governance of waterbodies to enhance the effectiveness and legitimacy of water management schemes across the EU.
Valentina,D.(2017) [19]	General	Provide public sufficient opportunities to safeguard environment.
Bernard, M. K. et.al.(2016) [20]	Air, Water and some other	Through concerned private citizens and visionaries change and enhance the Environmental conditions.
Wilhelmina, V.R.(2017)[21]	General	Involve public in Environmental Protection activities.
Thomas, J. et.al. (2018) [22]	General	Through Networks (Urban-Rural) people can make strong voice against Environmental Degradation.
Angela,J. D. et.al (2018) [23]	General	By providing citizens better/meaningful experiences and make them feel engaged more in Environmental Protection activities.

The government cannot make all the necessary arrangements or necessary steps to make sure environmental protection of a country. But through Citizen or public participation many of the environmental issues can be solved in less cost and in an effective manner. By empowering and involving citizens', effectivity and legitimacy of decision making process could be increased. Further , creating general awareness and establishing conflict resolution mechanisms also helps as remedy on environmental issues [18]. The Citizens can be together and concerned citizens and visionaries could build collectivist culture which leads to Community-building and community participation that would pave the way for the environmental protection[20]. Australian government has involved citizens in country's largest community-based environmental annual event to remove rubbish from their environment. Through this event the citizens knowledge about the environment and understanding about environmental issues has increased [21] . With the rapid development of economies sustainable development has become a challenge. For development activities environmental degradation is unavoidable. But at the same time citizen opposition activities and informal networks between citizens in the villages and urban activists formed a strong voice against environmental issues[22]. Another form of citizen engagement is providing citizens' a better and meaningful experiences and make them feel engaged more in environmental protection activities [23].

##### B. E-government and Environmental Sustainability

Under the category of e-government and environmental sustainability (Table III), three papers are carried out in general environmental issues. Out of them two of the research used Surveys as the research strategy [24] [25] and the other was based on a Case study [26] . As data collection methodology semi structured interviews, field observations,

web content analysis and analyzing secondary data sets have been applied in the research. The research was carried out in Japan, Southern European, Nordic countries and Small Island Developing States (SIDS) in Pacific, Africa, Indian Ocean, Mediterranean and South China. Citizen centric social governance Framework Analytical model to estimate the direct and indirect effects of e-government development on Environmental Sustainability.

TABLE III. ENVIRONMENTAL SUSTAINABILITY ASPECT VS. INVOLVEMENT OF E-GOVERNMENT

Citation	Environmental Sustainability Aspect	Involvement of E-government
Akemi T.C.;Christophe r G. R. (2016)[26]	General	Citizen Engagement for Smart City implementation
Andrés N.; Mercedes R.; Pilar T.;Araceli D.L.R.(2017)[24]	General	E-government services
Young B. L.(2017)[25]	General	E-government services/ICT based solutions(weather warnings, correct use of fertilizer

Many of the governments consider Environmental sustainability as critical global issue and they develop required policies to cater for the requirement of the citizens. Smart City is an emerging solutions for many of the environmental issues and to reduce city-wide carbon emissions it includes solutions such as smart micro-grids, smart meters, and home/building energy management systems[27]. The governments offer e-government services and ICT based solutions such as weather forecasts for precautions, warnings and alerts for disasters, correct use of fertilizer in agriculture etc.[25].

#### C. E-government, Environmental Sustainability and Citizen Participation

Author found only one research paper carried out in this category (Table IV). This paper has been applied in the Survey as a research strategy with a combination of data collection methods including online questionnaire, media data analysis and an online survey. It was carried out in Beijing, China.

TABKLE IV. ENVIRONMENTAL SUSTAINABILITY, E-GOVERNMENT AND CITIZEN PARTICIPATION

Citation	Environmental Sustainability	E-government	Citizen Participation
Guizhen ,H.et.al (2016) [3]	General	Provide platform for e-participation	Collaborative approaches through e-participation

This paper was carried out with the objective of understanding the interrelationship between e-government in promoting public participation for the purpose of environmental sustainability issues in urban China. Researcher's objectives are to analyze what public motivations, perception/attitudes and actions drive

environmental e-participation, identify barriers to e-participation and assess the different applications and functions of ICT for citizen participation in environmental sustainability. The government can offer more online services to the public. It is proved that general public is more interested to disclose their views through the use of ICT and E-platforms. This E-participation allows Citizens to work collaboratively and solve Environmental issues. [3]

#### V. DISCUSSION

This paper is aimed to obtain the comprehensive understanding towards the interrelationship between e-government, citizen participation and environmental sustainability by conducting a systematic literature review. The results surprisingly show the research in this focus is extremely rare. From the Web of science search we found that only one research has been carried out in E-governmental services for Citizen Participation in governing Environmental sustainability. Therefore, the research gap is identified.

Firstly, in addition to produce knowledge to understand social and economic sustainability, e-government research should pay more attention to explore e-government services for the purposes of environmental sustainability by engaging citizens.

All the nations and humans cannot deny the importance of environmental sustainability. The Human actions caused many of the environmental degradations. As citizens we all can agree and work together on our responsibilities to protect the environment for the sake of the future generations. Achieving this Environmental sustainability is a collective work and different stakeholders including government, technology providers and citizens' should work together with common objectives.

In the process, citizen participation plays a major role and there is no blueprint for best practice participation involving them in environmental sustainability endeavors. When a community work together with proper leaders, environmentally concerned citizens and visionaries it can make a revolution in the society. Involving citizens in community based events of environmental protection is considered as valuable part of their learning about the environment that contributed to their understanding about sustainability and improves the power of positive community participation as a force for good. Through careful design of citizen science programs on environmental issues, community could be educated on environmental impacts while providing meaningful experiences and building environmental skills.

The new merging trends in ICT such as IoT, Big Data, Sensor technologies, Artificial Intelligence etc. have taken citizen engagement in to a new direction. Through this emerging technologies citizens will get enough channels for public voice on environmental governance and sustainability issues which was not well looked after by the relevant authorities under the government. While these technologies will enhance the public voice, it allows citizens to contribute on different collaborative approaches to solve problems. It is well proved that compared to offline, citizens prefer to use online platforms, ICT tools and Internet to engage in expressing their views and to be involved in environmental public participation.

So far, not many governments are pursuing many e-government projects to maintain environmental sustainability. Though politicians and decision makers believe development of e-government as major requirement for environmental sustainability[25].

Secondly, the evidences (see section 4) have shown that citizen's participation to environmental issues are increasing and have resulted in valuable and positive consequences both for citizen's daily life and for protecting environments. However, a broad range of issues needs to be considered in order to enable citizen participation, such as access to information, equality, enabling participation of representative groups, the specifications of participation in different contexts, and a legal framework enabling meaningful participation, especially for environmental issues. Furthermore, participation is essentially unequal, as participants basically always represent specific groups, contexts, experiences and opinions. In a research [28] it points out that the main focus of, e.g., e-government is usually merely on enhanced public services and improved government operations, while how to support the transformation of governments into more open and interactive operating modalities is given considerably less attention; this fundamentally obstructs a rapid and efficient transition to an inclusion of systematic open and participatory mechanisms in the general governance. Ambitions with a more participatory and responsive government are therefore often not fulfilled, as pointed out. [29] [30].

Thirdly, Citizens are more vigilant than ever in achieving environmental sustainability. More research is needed to explore how e-government services can be improved/developed for coping with different environmental issues through collective action with the citizens[2]. Future research can be conducted to provide better understanding of how to make value co-creation successful in the public sector, i.e. how to co-create public value especially for environmental sustainability. "Governments have to learn to promote innovation and create public value not through direct intervention, but by leveraging and enabling the best capacities of citizens to be deployed and fully realized." In particular, research can pay attention to a growing area of research on "citizen observatories" as a socio-technical innovation that brings together both digital technologies and political decision making processes to contribute to sustainable and resilient social ecologies[2].

Finally, research is called for understanding how developing countries improve their e-government services for citizen participation in governing environmental sustainability. The literature shows that most of the studies were conducted in developed countries which may indicate that these countries have strong intentions and endeavors to achieve environmental sustainability. However, developing countries face more challenges in sustaining environment. Digital technologies offer significant support for the governments to make faster progress in changing circumstances for improving public policy-making capacity and engaging citizens in improving environment. During recent past, Sri Lanka as a nation challenged by nature and end up with environmental disasters including losses of people's life. Deforestation (Deforestation has increased soil erosion, landslides, floods, fauna and flora degradation, and

damage to human lives and properties), Garbage and Pollution, Wildlife Poaching, Coastal Degradation, Mismanagement of Land use Changes due to Tsunami Resettlement, Freshwater Pollution, Urban and Industrial Wastes, Destruction of Mangroves, Air Pollution are some of the major environmental issues in Sri Lanka [13]. We aim to conduct empirical research in Sri Lanka to understand environmental issues, design solutions, and contribute knowledge towards this research focus.

## VI. CONCLUSION

The existing literature proves that research carried out in digital government services for citizen participation in governing environmental sustainability is extremely rare. More research is required in this research focus. We argued the three important areas that we can continue to conduct research and bring better understanding of improving/designing e-government services for citizen participation and addressing environmental sustainability.

Although the Web of Science database collects important research our research focus across disciplines, we may unfortunately miss many articles which may not include in this database. In our future research, we will enlarge the search scope to other databases, for example, Scope, Springer, as well other conferences proceedings.

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# Customer Churn Analysis and Prediction in Telecommunication for Decision Making

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**Abstract**— *With the rapid development of communication technology, the field of telecommunication faces complex challenges due to the number of vibrant competitive service providers. Customer Churn is the major issue that faces by the Telecommunication industries in the world. Churn is the activity of customers leaving the company and discarding the services offered by it, due to the dissatisfaction with the services. The main areas of this research contend with the ability to identify potential churn customers, cluster customers with similar consumption behavior and mine the relevant patterns embedded in the collected data. The primary data collected from customers were used to create a predictive churn model that obtain customer churn rate of five telecommunication companies. For model building, classified the relevant variables with the use of the Pearson chi-square test, cluster analysis, and association rule mining. Using the Weka, the cluster results produced the involvement of customers, interest areas and reasons for the churn decision to enhance marketing and promotional activities. Using the Rapid miner, the association rule mining with the FP-Growth component was expressed rules to identify interestingness patterns and trends in the collected data have a huge influence on the revenues and growth of the telecommunication companies. Then, the C5.0 Decision tree algorithm tree, the Bayesian Network algorithm, the Logistic Regression algorithm, and the Neural Network algorithms were developed using the IBM SPSS Modeler 18. Finally, comparative evaluation is performed to discover the optimal model and test the model with accurate, consistent and reliable results.*

**Keywords**—*bayesian network, c5.0 decision tree, logistic regression, neural network*

## I. INTRODUCTION

Decision making is a key feature of every organization. The quality of decisions made is dependent on some amount of knowledge generated from existing or researched information. The use of modern analytical tools to generate such knowledge is reasonable for any profit-driven firm. Taking decisions on customers is one of the key points in most companies, especially companies in the service sector. The ability of these companies to predict customer churn is critically inadequate. Customer churn is the action of the customer who is like to leave the company and it is one of the mounting issues of today's rapidly growing and competitive telecommunication industry. To minimize the customer churn, prediction activity to be an important part of the telecommunication industry's vital decision making and strategic planning process.

## A. Churn Prediction

Today numerous telecom companies are prompt all over the world. Telecommunication market is facing a severe loss of revenue due to increasing competition among them and loss of potential customers [1]. Churn is the activity of the telecommunication industry is the customers leaving the current company and moving to another telecom company. Many companies are finding the reasons of losing customers by measuring customer loyalty to regain the lost customers. To keep up with the competition and to acquire as many customers, most operators invest a huge amount of revenue to expand their business in the beginning [2]. In the telecommunication industry each company provides the customers with huge incentives to attract them to switch to their services, it is one of the reasons that customer churn is a big problem in the industry nowadays. To prevent this, the company should know the reasons for which the customer decides to move on to another telecom company. The Telecom Churns can be classified into two main categories: Involuntary and Voluntary. Involuntary are easier to identify. Involuntary churn is those customers whom the Telecom industry decides to remove as a subscriber. They are churned for fraud, non-payment and those who don't use the service. Voluntary churn is difficult to determine because it is the decision of the customer to unsubscribe from the service provider. Voluntary churn can further be classified as incidental and deliberate churn [3]. The former occurs without any prior planning by the churn but due to change in the financial condition, location, etc. Most operators are trying to deal with these types of churns mainly.

## B. Churn Management

Churn management is very important for reducing churns as acquiring a new customer is more expensive than retaining the existing ones [4]. Churn rate is the measurement for the number of customers moving out and in during a specific period of time. If the reason for churning is known, the providers can then improve their services to fulfill the needs of the customers. Churns can be reduced by analyzing the past history of the potential customers systematically [5]. A large amount of information is

maintained by telecom companies for each of their customers that keep on changing rapidly due to a competitive environment. The information includes the details about billing, calls and network data. The huge availability of information arises the scope of using Data mining techniques in the telecom database. The information available can be analyzed in different perspectives to provide various ways to the operators to predict and reduce churning. Only the relevant details are used in the analysis which contributes to the study from the information given. Data mining techniques are used for discovering the interesting patterns within data and it helps to learn to predict whether a customer will churn or not based on customer's data stored in the database.

### C. Research Objectives

The main objective of this research is to produce a predictive model with better results that assess customer churn rate of telecommunication companies using the predictive analytics algorithm for data mining.

The supporting objectives examined are to:

- Cluster customers into various categories to enhance marketing and promotional activities.
- Mine the relevant patterns embedded in the collected data have a huge influence on the revenues and growth of the Telecommunication companies.

## II. METHODOLOGY AND EXPERIMENTAL DESIGN

Data mining and statistical algorithms were used in the data analysis, model building and model deployment in this research. Weka 3.8, Minitab 17, RapidMiner Studio 8.1 and IBM SPSS Modeler 18 were the analytical tools used in the respective analysis and mining process.

### A. Data Collection

The questionnaire was used as the tool to collect the data primarily from customers. The Google drive plug-in was used to design the questionnaire. Training data was collected from the 200 respondents and 50 responses were received from respondents on the questionnaire for testing data. The data was collected during the period (October – November) of 2017.

TABLE 1: THE VARIABLES USED IN DATASET FOR THIS RESEARCH

No	Variable Name	Description
1	Age, Gender, Occupation	Demographic variables considered
2	The number of networks	Identifies the number of mobile networks a customer is connected to and actively using
3	Frequently used network	Identifies the most frequently used mobile network by the consumer

4	Tariffs	The type of customer, whether a prepaid or post-paid customer
5	Tenure	Length of time a customer has been with a particular subscriber
6	Credit purchase amount (CpM)	Approximates the amount used to purchase call credits a month in rupees
7	Data purchase amount (DpM)	Approximates the amount used to purchase data bundles a month in rupees
8	Internet usage	Identifies whether customer have used internet facility or not
9	Product innovation	Determines whether product innovation is necessary for sustaining customers
10	Churn	Identifies whether customer have changed networks or not

### B. Data Pre-processing

The training and testing dataset used in this research may be included missing data, repeated data or inconsistent data. To handling missing data and removing duplicated data values data pre-processing is done. The RapidMiner tool is used at this stage to pre-process the data for analysis and mining. In doing cluster analysis, the Pearson chi-square and predictive model building, the data types to be converted into numerical values.

TABLE 2: CODES FOR ALTERNATIVES

Variable	Alternative	Code
Gender	Female	0
	Male	1
Occupation	Student	1
	Government Employee	2
	Private Employee	3
	Own Business	4
	Others	5
Network often used	Dialog	1
	Mobitel	2
	Airtel	3
	Hutch	4
	Etisalat	5
Tenure	Less than 1 year	1
	1-3	2
	3-5	3
	Above 5	4
Churn	No	0
	Yes	1
Tariffs	Pre-paid	1
	Post-paid	2
	Both	3
Usage of Internet	No	0
	Yes	1
Product innovation	No	0
	Yes	1
	Not sure	2

### C. Research Framework

In figure 1, a research framework developed to address problems of this research. This research framework details the sectorial areas of concentration and the data mining algorithms adapted in creating the predictive model. It includes a model deployment and evaluation strategies that will assess its effectiveness and efficiency.



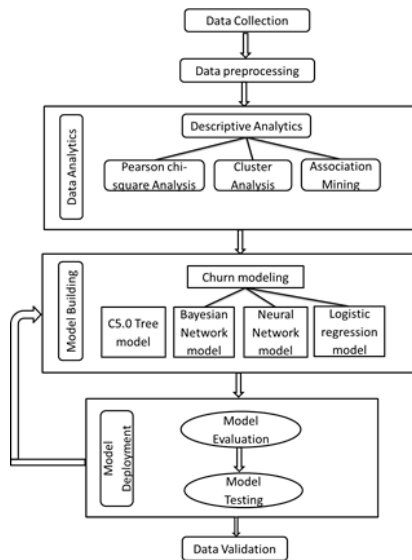


Figure 1: Research framework of Customer Churn Analysis and Prediction in Telecommunication

### III. RESULTS

#### A. Pearson Chi-square Test

Pearson Chi-square test is used to evaluate the variables which are associated with the decision of churn that can be used in the predictive model building. Pearson and likelihood ratio chi-square tests are conducted using Minitab. The test produced significant results ( $p$ -value is less than  $\alpha$  level of 0.05) to indicate that some of the variables have an association with the decision to churn.

TABLE 3: SUMMARY OF ASSOCIATION OF EACH ATTRIBUTES THE CHURN DECISION

Variable	P-Value	Association
Marital Status	0.645	No
Gender	0.038	Yes
Age	0.005	Yes
Occupation	0.011	Yes
Monthly Income	0.001	Yes
Purpose of mobile phone usage	0.107	No
No of mobile network connected	0.003	Yes
Mobile network often used	0.006	Yes
Tenure	0.000	Yes
CpM	0.004	Yes
Tariffs	0.029	Yes
Internet usage	0.020	Yes
DpM	0.105	No
Product Innovation	0.021	Yes

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Cluster Analysis is used to discover groups with identical features in collected data. These groups explained the interest areas and churn decision with the reasons for targeted marketing and product development. Using Weka 3.8 the k-

means clustering produced four clusters out of the 200 collected data.

TABLE 4: CLUSTER INSTANCES WITH PERCENTAGE

Cluster Number	Clustered Instances	Percentage (%)
Cluster 0	69	17
Cluster 1	34	32.5
Cluster 2	65	16
Cluster 3	32	34.5

TABLE 5: FINAL CLUSTER CENTROIDS

Variable	Full Data (200.0)	Cluster 0 (69.0)	Cluster 1 (34.0)	Cluster 2 (65.0)	Cluster 3 (32.0)
Gender	0.515	1	1	0	0
Age	33.24	35.49	54.79	22.93	26.40
Occupation	2.305	2.6232	4.0882	1.18	2
Monthly Income	31827.5	38833.33	61617.64	10984.61	27406.25
NoOfMobileNetworkConnected	2.125	2.5217	3	1.30	2
MobileNetworkOftenUsed	2.195	2.2609	4.52	1	2
Tenure	3.085	3.7391	4	1.95	3
Tariffs	1.325	1.1884	1.38	1.35	1.5
CpM	1003.25	1105.79	1948.52	504.61	790.62
Internet Usage	0.8	1	1	0.3846	1
Churn	0.675	1	1	0	1

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Telecom providers can leverage this cluster model to allocate customers' for conducted promotional activities. It is observed in the clusters that the churners are mostly businessman and private employees who are generally males and government employees who are female. These churners spend a lot of call credit per month and used prepaid service package. The customers do not intend to churn are mostly students who are generally females. Telecom providers, especially those who have endured a churn of customers need to pay attention in this cluster to the reason for churn as presented by these customers.

#### B. Association Rule Mining

Association rule mining used to determine interestingness patterns and trends between variables in the dataset. It is contracted to identify strong rules explored in the dataset using some measures of interestingness. The RapidMiner Studio 8.1 tool was used in creating the Association rules model for collected data. In creating the model, the Frequent

Pattern Growth (FP-Growth) algorithm was used to mine associations between variables that result in a churn decision with particular interest and focus on confidence. The generated Association rules model presented in Figure 2.

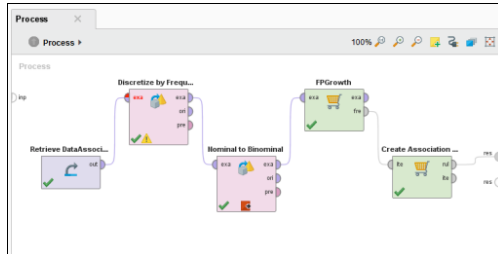


Figure 2: Association rules model

In the Table 6 showed ten (10) generated association rules were selected based on filtering the conclusion as the decision of churn is yes and sorted in descending order in line with confidence. The sorted rules have a maximum confidence of 95.5 percent and a minimum of 84.6 percent.

TABLE 6: TOP (10) GENERATED RULES

No	Premises	Conclusion	Support	Confidence	Laplace
1	InternetUsage= Yes, Gender =Male and Tenure = 3-5 years	Churn_Yes	0.105	0.955	0.995
2	Tariffs=Prepaid, Gender=Male and Tenure= 3-5 years	Churn_Yes	0.100	0.952	0.995
3	Gender=Male and Tenure=3-5 years	Churn_Yes	0.130	0.929	0.991
4	MobileNetwork OftenUsed=Mobile and Tenure=3-5 years	Churn_Yes	0.115	0.920	0.991
5	InternetUsage= Yes and MobileNetwork OftenUsed=Mobile	Churn_Yes	0.105	0.913	0.991
6	Tariffs=Prepaid and Tenure= 3-5 years	Churn_Yes	0.230	0.902	0.980
7	InternetUsage= Yes, Tariffs=Prepaid and Tenure= 3-5 years	Churn_Yes	0.190	0.884	0.979
8	Tenure= 3-5 years	Churn_Yes	0.270	0.871	0.969
9	Tariffs=Prepaid, Gender=Female and Tenure= 3-5 years	Churn_Yes	0.130	0.867	0.983
10	InternetUsage= Yes,	Churn_Yes	0.110	0.846	0.982

Tariffs=Prepaid and Gender=Female				
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### B. Predictive Model Building

Using the valid variables identified in the Pearson Chi-square test, the four predictive models are created with IBM SPSS Modeler 18.0 data mining software. The four classification modeling techniques; C5.0 tree, the Bayesian network, Neural Network and Logistic regression are used to create predictive models. The optimal model is recommended based on individual models and performance metrics.

An auto classifier was applied in the created C5.0 tree model in Figure 3, to test whether the selected C5.0 algorithm will be determined as one of the best algorithms to create the predictive model.

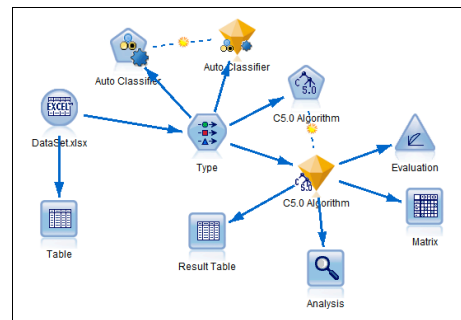


Figure 3: C5.0 algorithm tree model

The C5.0 algorithm was listed in the suggested churn algorithms which were applied to the data. In Figure 3, the matrix was applied to create a table showing the relationship between fields of Churn by \$C-Churn. In the created above model, analysis and evaluation are used to create a report and a chart for comparing the accuracy of predictive models.

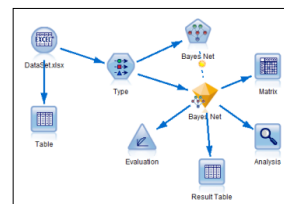


Figure 4: Bayesian network model

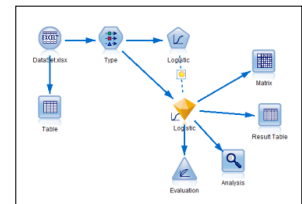


Figure 5: Neural network model

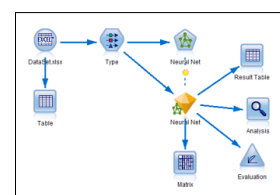


Figure 6: Logistic regression model

As the result of generating the logistic regression model, it built up a statistical model which consists of two mathematical equations to calculate the ability of a person being churner or non-churner.

Equation 1: Calculating Y'

$$Y' = 0.0682 * \text{Gender} + (-0.00182) * \text{Age} + 0.04558 * \text{Occupation} + 0.00001458 * \text{MonthlyIncome} + (-0.7214) * \text{Tenure} + (-0.2053) * \text{Tariffs} + 0.00001024 * \text{CpM} + 2.659$$

Equation 2: Calculating P(1)

$$P(1) = \frac{\exp(Y')}{1 + \exp(Y')}$$

Equation 1 consists of most relevant variables which are most affected by the churn decision. The variables values should be replaced by this equation and then the value of Y' can be calculated. Then the calculated Y' value should be replaced with the equation 2 and calculate the value of P(1). Prediction of being a churn or non-churn customer is depending on this P(1) value.

If the P(1) value is equal or greater than 0.5, then the prediction result is positive and the person will be a churner. If the P(1) value is less than 0.5, the result is close to 0 (zero). It means the prediction result is negative and the person will be a non-churner.

### C. Model Evaluation

The four models are evaluated by testing the significance of the predictive model generated. The performance metrics of all the models were correlated for optimal performance using Area Under Receiver Operating Characteristic Curve (AUROC).

TABLE 7: CONFUSION MATRIX WITH TRAINING DATA

Model	Accuracy (%)	AUC Value
C5.0 algorithm model	85	0.888
BA model	79	0.886
LR model	72	0.762
NN model	70	0.759

The variables were equally tested for validity and reliability. The validity of the model indicates that it measures what it is intended for while reliability test produces consistent results. The tests assessed the efficiency

and effectiveness of the model in predicting customer churn in Telecommunication.

C5.0		no	yes	% correct
	no	45	20	69.2
	yes	10	125	92.5
Overall Percentage				85%
BN		no	yes	% correct
	no	47	18	72.3
	yes	24	111	82.2
Overall Percentage				79%
LR		no	yes	% correct
	no	27	38	41.5
	yes	18	117	86.6
Overall Percentage				72%
NN		no	yes	% correct
	no	21	44	32.3
	yes	16	119	88.1
Overall Percentage				70%

TABLE 8: ACCURACY AND AUC VALUE OF EACH MODEL

Contrasting the four models, the C5.0 algorithm of decision tree proved optimal model with 85% accuracy and AUC value as 0.888 for the customer churn analysis and prediction in Telecommunication based on the chosen variables and attributes.

### D. Model Testing

The optimal model based on the results of the evaluation is tested on the dataset designed to test the model. The C5.0 algorithm model was used to test the data as it was identified as the most optimal among the models. The chosen optimal model was tested using the test data collected from customers. The test data has 50 observations, 7 variables and coded the same as the coding in Table 2. The distribution of the dataset is along with all the gender, age, monthly income, occupation and the other demographic and operational variables used to develop the model. Predictions are then made to indicate which customers are likely to churn and those that are not. The predictor variable and target variables used in building the predictive churn model were tested for significance.

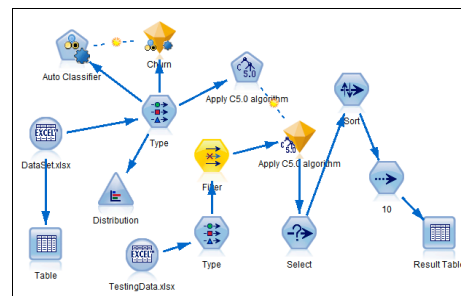


Figure 7: Test model for C5.0 algorithm

The test data is applied by mapping the dataset to the model designed by the C5.0 algorithm as indicated in Figure 7. Further model screening and applications are initiated to define the output in determining the likelihood of churn. The test results presented as the model predicted that 36 customers will churn with confidence from 100% to 55.6%. It was further explained by the results that over 62% of the churn customers have a confidence of above 80%. According to the Figure 8, the results also indicate the churn customers staying their network above 5 years. It is expensive to acquire new customers than to retain existing ones, the prediction of churners and the reasons proffered earlier need close attention. The top 10 churners and non-churners predicted by the model are presented in Figures 8 and 9 respectively. The source of the test data set can be connected to the database or server of the company to produce a real-time output of churn results for decision making.

Table	Annotations									
	Gender	Age	Occupation	MonthlyIncome	CpM	Tenure	Tariffs	SC-Churn	SCC-Churn	
1	1.000	20...	1.000	8000.000	400.0...	2.000	1.000	No		1.000
2	1.000	55...	4.000	40000.000	2500...	4.000	2.000	No		1.000
3	1.000	55...	4.000	60000.000	2500...	4.000	2.000	No		1.000
4	1.000	28...	3.000	42000.000	1200...	4.000	3.000	No		1.000
5	1.000	20...	1.000	8000.000	500.0...	2.000	1.000	No		1.000
6	0.000	38...	3.000	50000.000	2000...	4.000	3.000	No		1.000
7	1.000	60...	2.000	28000.000	1500...	4.000	2.000	No		0.833
8	0.000	45...	2.000	42000.000	1500...	4.000	2.000	No		0.833
9	0.000	52...	2.000	28000.000	1500...	4.000	2.000	No		0.833
10	0.000	52...	5.000	20000.000	1000...	4.000	2.000	No		0.750

Figure 8: Results of test predictions\_Yes

Table	Annotations									
	Gender	Age	Occupation	MonthlyIncome	CpM	Tenure	Tariffs	SC-Churn	SCC-Churn	
1	0.000	25...	1.000	12000.000	600.0...	4.000	1.000	Yes		1.000
2	0.000	25...	1.000	10000.000	600.0...	4.000	1.000	Yes		1.000
3	0.000	25...	1.000	12000.000	500.0...	4.000	1.000	Yes		1.000
4	1.000	39...	3.000	40000.000	1000...	2.000	3.000	Yes		0.938
5	1.000	31...	2.000	35000.000	1500...	2.000	2.000	Yes		0.938
6	0.000	34...	5.000	25000.000	1000...	2.000	1.000	Yes		0.938
7	0.000	40...	4.000	15000.000	1200...	2.000	1.000	Yes		0.938
8	1.000	39...	3.000	38000.000	800.0...	2.000	1.000	Yes		0.938
9	0.000	41...	2.000	35000.000	1000...	2.000	1.000	Yes		0.938
10	0.000	30...	2.000	28000.000	800.0...	2.000	1.000	Yes		0.938

Figure 9: Results of test predictions\_No

## V. DISCUSSION AND CONCLUSION

Data mining is a symbolic tool in the Telecommunication industry that can exploit the large volume of data generated for pattern analysis. The recent increasing embrace of the predictive algorithm of data mining has given room for companies to assess their future success, challenges, and targets. The research brings to fore the relevant untapped customer data and knowledge for churn prediction and customer classification for better decision making. Clustering customers were developed in this research to determine the involvement of customers, interest areas and reasons for the churn decision. The results of the cluster analysis can be used in promotional and direct

marketing purpose to access marketing strategies in the industry. In addition, the association rule mining was provided the significant results that present relevant knowledge of factors that have a huge influence on the revenues and growth of the Telecommunication companies. Telecommunication companies must grasp on this finding and work to maintain their clients. C5.0 Decision tree model, the Bayesian Network model, Logistic Regression model, and the Neural Network model were used and compared for the most optimal model that predicts accurately. The C5.0 algorithm of decision trees model proved optimal among the models with 85 percent accuracy and AUC value as 0.888. The C5.0 algorithm model of the decision tree can be recommended for churn management. The models can be used by industry with the IBM SPSS Modeler or any other appropriate tool with the same algorithm. The Telecommunication companies can connect the models directly to their servers or database to produce real-time results.

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# Board Characteristics and Dividend Policy -The Study of Banking and Finance Sector in Sri Lanka

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**Abstract**— The mere motive for the researchers to seek answers for the query on payment of Dividends by companies and the affecting factors for the payment of Dividends was majorly due to the prevailing issue of problem of Dividends since 1950s. The study is based on how one of the main components of corporate governance, which is the Board characteristics, has influenced dividend policy. The data for this paper was gathered Banking and Finance sector companies in Colombo Stock Exchange taking the last 5-year figures as a base.

Dividend Decision and Dividend payout were taken into reflection for the measurement of Dividend policy. And the three analytical strategies of Descriptive Statistics, Binary Logistic Regression and Panel Regression were taken as tools of analysis. Descriptive statistics were used to understand the nature of board characteristics in Banking and Finance sector of Sri Lanka. The effect on Board characteristics on dividend decision was expansively defined in Binary Logistic regression. The effect on level of dividend payout through Board characteristics were discussed through Panel Regression.

Descriptive statistics generated a percentage of 18.48% when finding out average of dividend payout for last 5 years. Women on board seemed to show a percentage of 11.86% in Banking and Finance sector. This concludes that board gender diversity is far less in Banking and Finance sector of Sri Lanka with an average Board size of 8. Leverage of 76% was depicted in Bank and Finance sector.

The likelihood to pay dividends is affected positively by women on board, board size, CEO duality, board meetings and firm size. Audit committee size, Board independence and Leverage showed a negative relationship with likelihood of dividend payout. Out of mentioned relationships, women on board, Board size and CEO duality have a significant positive relationship with likelihood of dividend payout.

It is documented that dividend payout of Banking and Finance companies listed in CSE is affected positively by Audit committee size, Board independence, Board meetings and CEO duality. Out of those variables Board independence and CEO duality had significantly positive relationship with the level of the dividend payout. Dividend payout was negatively affected by Board gender diversity and Board size. Negative relationship of Board size was significant at 0.05 significance level.

**Keywords**— corporate governance, board characteristics, dividend policy, binary logistic regression, panel regression

## I. INTRODUCTION

Why companies pay dividends? Moreover, what are the factors that determine the dividend policy of the companies? The empirical studies on the determinants of dividend policy are basically based on the various theoretical explanations given in the different competing theories. However, the results widely vary across the countries and the time periods. Therefore, time to time the empirical examination of factors affecting the dividend policy has been warranted.

The studies on the dividend policy have attempted to answer three questions:

- a) Why companies pay dividends?
- b) Does the dividend policy affect the value of the firm?
- c) What are the factors that determine the dividend policy?

Among the early studies on this issue, Linter (1956) argues that firms target their desired payout ratio, and it is determined by the current earnings and past dividends of the companies. Considering certain unrealistic assumptions like (a) there is no tax, (b) there is no agency cost, (c) there is no asymmetric information, (d) there is no transaction costs and so on. Miller and Modigliani [1] are of the opinion that the dividend policy is irrelevant in measuring the value of the firm or shareholder's wealth in a perfect market. Over the years relaxing all these unrealistic assumptions taken by Miller and Modigliani, a large amount of research has been carried out on firms' dividend policy. This research has led to number of competing theories such as tax clientele theory, signaling theory, agency theory, firm life cycle theory and so on to explain the dividend payout ratio of the companies. The tax clientele theory states that investors in low tax bracket prefer the high dividend paying stock, and investors in high tax bracket prefer low dividend paying stocks [2]. The other argument related to tax is that if the dividend tax is more than the capital gain tax then investors do not prefer dividends [3]. The advocates of signaling theory argue that the payment of dividend convey private information about current and future earnings and it can be used to minimize the information asymmetry between the insider and outsider, therefore, the dividend policy does affect the value of the firm [4]. The agency cost theory views that dividend payments would reduce the extra discretionary power of the managers and thus reduce the agency problem arising between the shareholders and managers [5]. Therefore, a positive relationship can be expected

between dividend payout ratio and the value of the firm. If taken averagely, the market reacts positively towards dividend announcements [6].

Corporate governance matters for the dividend policies of the firms. In the literature dividend behavior is used as the outcome of the governance [7]. The standard of corporate governance and investor protection are lower in south Asian countries and compared to the US and Japan [8] and identified the positive relationship between managerial ownership and firm value.

Another study regarding the relationship between the board independence and dividend policy for the Sri Lanka hotel industry concluded that there is statistically significant relationship between the board independence and dividend payout ratio [9]. Research conducted by Mansourinia [10] argued that there is no significant relationship between the board independence and dividend payout ratio. There is significant and positive relationship exists between board independence and dividend payout ratio among the Egyptian companies empirically argued by Abor and Fiador [11].

In this paper, researcher will highlight this debate by studying how board characteristics influence the payout policy using a sample of listed companies listed in Colombo stock exchange.

This is one of the first attempts at examining the relationship between board characteristics and dividend policy for Sri Lankan companies, with the analysis distinctively informed by agency theoretical insights drawn from the outcome and substitution hypotheses.

## II. LITRETURE REVIEW

According to the statement brought up by Al-Najjar and Hussainey [12] the existence of outside directors may hold a direct influence over the effectiveness of the board as per their power to safeguard the wealth of the shareholders in the form of dividend payout. Furthermore, Borokhovich [13] suggested that outside directors have immense incentive to control and monitor managers' opportunistic behavior with the mere intention of augmenting their image in the labour market.

But, with accordance to the past studies [13] there was a negative relationship which was found between the outside directors and dividend payout policy. Similarly, Al-Najjar and Hussainey [12] reported a negative relationship between the number of outside directors and dividend payout after considering 400 non-financial firms. Cadbury report [14] and Combined Code [15] stated that it is favorable to have majority of board members as outside directors.

Once too much of executive power is given to the CEO, after joining CEO and chairperson roles, it would ultimately lead to agency problems, as they tend to chase after their own personal interests at the cost of the shareholders [16]. When the two roles of CEO and chair are merged, it could also negatively effect on board independence as it could lead to a reduction in scrutinizing the activities of the top management [17]. On the other hand, due to lack of monitoring of the activities of the top management, it could ultimately grant the CEOs the fortune of seize shareholders' wealth by paying low or

no dividends to the shareholders. As a result, with the base of substitute hypothesis, if a company holds a collective control they are obliged to pay higher dividends in order to eliminate meager governance resulted by CEO role duality [18].

Earlier evidence on the connection between dividend payout rates and CEO duality is normally mixed. As per the previous studies showed [11] there was a negative connotation between dividend payout policy and CEO duality. But on the other hand there was no association which was found between CEO duality and dividend payout policy in Iranian, US and Malaysian listed firms [10]. Cadbury report [14] and Combined code [15] stated the opposite statement, with reference to the UK regulatory perspective, most of the UK governance reforms indicate that roles of chairperson and CEO should be in separation if they are to develop board independence.

In order to carry out the business without any challenges it is important to have a sufficient number of board members in a firm [14]. In order to control the opportunistic behavior of the management, large boards could be effective as larger boards have the capability of increasing performance of the firm, minimize agency problem as well as dividend payout. But with accordance to the substitution hypothesis, larger boards lack effectiveness in monitoring opportunistic behavior of management as they are attached with the problem of co-ordination and communication, which ultimately leads to poor governance [10]. Previous studies on the connection between board size and dividend payout policy are assorted. With a sample of Australian companies, Kiel and Nicholson [19] proved the same positive relationship between the two.

## III. METHODOLOGY

The researcher applied "Quantitative Research Approach" to conduct this study. "Quantitative research" most often uses deductive logic, in which researchers start with hypotheses and then collect data which can be used to determine whether empirical evidence to support that hypothesis exists.

The study was based on "Secondary Data Analysis". Data collected for nine variables using audited annual reports of 239 companies listed in Colombo stock exchange. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

### A. Sample Selection

To measure the impact of board characteristics on dividend policy, initial sample of 70 quoted public companies were selected. This sample covered all the companies registered under Banking and Finance business sector in Colombo stock exchange. Reasonable care has been exercised in order to select a large number of companies to provide more valid research findings.

A company was selected for the final sample only if the following selection criteria were satisfied.

a) The company should be listed in the Colombo Stock Exchange throughout the sample period .That is during the period of year 2013 to 2017.

b) Required information should be available during the period of 2013 to 2017.

After the consideration of above mentioned criteria, following final sample has been used for the research.

Table 3.1: Final Sample

Sector	Initial Sample	Excluded	Final Sample
Banking, Finance and Insurance	70	10	60

Source: Author's source

Required data for the selected variables of board characteristics has been collected from the published financial statements of the companies included in final sample. The research based on secondary data and time span of the study was from 2013-2017.

#### B. Hypothesis Development

After a rigorous process of the Literature review, author determined to test six hypothesis developed from board characteristics. Planned six hypothesis backed by literature are as follows.

H1: There is a positive relationship between board size and dividend payout rate.

H2: There is a negative relationship between board independence and dividend payout rate.

H3: There is a negative relationship between CEO duality and dividend payout rate.

H4: There is a negative relationship between the frequency of board meetings and dividend payout rate.

H5: There is a negative relationship between board gender diversity and dividend payout rate.

H6: There is a positive relationship between audit committee size and dividend payout rate.

#### C. Definition of Variables and Model Specifications

Based on the hypothesis developed above, table 1 represents the proposed variables, abbreviations, nature of the variables and measurement techniques of proposed study. Two control variables to be used in order to account for potential "Omitted variable bias".

Table 3.2: Variable description

Variable	Abbreviation	Nature
----------	--------------	--------

1.Board Size	BOD_S	Independent
2.Board Meetings	BOD_M	Independent
3.Board Independence	BOD_I	Independent
4.CEO Duality	CEO_D	Independent
5.Board Gender Diversity	BOD_G	Independent
6.Audit committee size	AUD_S	Independent
7.Firm size	FIRM_S	Control
8.Leverage	Lev	Control
9.Dividend Decision	DD	Dependent Variable
10. Dividend Payout	DP	Dependent Variable

Source: Author's Source

Assuming that all the hypothesized relationships are linear, model 01 to be estimated is specified as follows:

#### Binary Logistic Regression (Model 01)

$$DD_{it} = \alpha_0 + \beta_1 BS + \beta_2 BM + \beta_3 BI + \beta_4 CD + \beta_5 BD + \beta_6 AS + \sum_{i=1}^n \beta_i CONTROLS + \epsilon_{it}$$

Where: DD is the main dependent variable; BS, BM,BI,CD,BD,AS are independent variables; and CONTROLS refers to control variables including FS, L.

Assuming that all the hypothesized relationships are linear, model 02 to be estimated is specified as follows:

#### Panel Regression (Model 02)

$$DP_{it} = \alpha_0 + \beta_1 BS + \beta_2 BM + \beta_3 BI + \beta_4 CD + \beta_5 BD + \beta_6 AS + \sum_{i=1}^n \beta_i CONTROLS + \epsilon_{it}$$

Where: DP is the main dependent variable; BS, BM,BI,CD,BD,AS are independent variables; and CONTROLS refers to control variables including FS, L.

This study is mainly based on four analytical strategies as follows. Descriptive Statistics Binary Logistic Regression, Panel Regression.

#### IV. ANALYSIS AND DISCUSSION

Three econometric methods have been used to analyze the relationships between "Board Characteristics" and "Dividend Policy". Descriptive Statistics has been used to explain important statistics regarding all the variables. Then Binary Logistic Regression has been applied to find out the relationships between board characteristics and dividend decision whereas dividend decision (dependent variable) was measured in binary terms. 1 for payment of dividends and 0 for nonpayment of dividends. Finally Panel regression was applied only for dividend paid firm-year observations in order to identify the relationship between board characteristics and dividend payout.

#### A. Descriptive Statistics

The descriptive statistics for the study of variables related to 300 firm-year observations of 60 companies listed under Banking and Finance business sector for the period of 2012-2016. The proportion of women on boards (BOD\_G) ranges from 0 to 0.375 with an average of 0.1186, which implies that the presence of women on the



boards of Banking and Finance companies is considered low. Furthermore, the presence of non – executive independent directors on boards (BOD\_I) ranges from 0 to 9 with an average of 3.24. Considering number of directors on boards (BOD\_S) ranges from 5 to 16 with an average of 8.13, average value of 3.24 for board independence implies that Banking and Finance sector considers board independence as important board characteristic for better governance mechanism. As can be noticed from table 08, board meetings (BOD\_M) held per year ranges from 2 to 28 with an average of 10.83 which is satisfactory with regards to “Code of Best Practices for Corporate Governance 2017” issued by CA Sri Lanka. It emphasizes that board meetings should be held at least once in every quarter of a financial year (Principle A.1.1). As per the mentioned Corporate Governance code, Audit committee should consist at least three non-executive directors. In Banking and Finance sector, number of non-executive directors in an audit committee (Aud\_S) ranges from 2 to 7 with an average of 3.23 which indicates Banking and Finance sector comply with audit committee requirements. Moreover, dummy variable has been used to measure whether there is a separation of positions of Chairperson and Chief Executive Officer (CEO\_D). Result shows an average of 0.91, most of the companies registered in Banking and Finance sector separated two positions during 2012 to 2016. The dependent variable of the model dividend payout ranges from -82% to 109% with an average of 18.48%. The data set was controlled for Firm Size (Firm\_S) which was measured by total assets of the firm and Leverage which was measured by debt to asset ratio. Average value of firm size was Rs. 9825 mn (natural log value 9.1927). Average percentage for leverage of a firm was 76%. Average percentage for Leverage ratio confirmed the unique nature of the Banking and Finance industry with regards to financial leverage.

### B. Binary Logistic Regression Results

Table 4.1: Binary Logistic Regression Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AUD_S	-0.1271	0.1167	-1.0894	0.2760
BOD_G	2.3754	1.2204	1.9464	0.0516
BOD_I	-0.0126	0.1054	-0.1196	0.9048
BOD_M	0.0324	0.0333	0.9749	0.3296
BOD_S	0.2876	0.0755	3.8093	0.0001
CEO_D	2.0110	0.8155	2.4659	0.0137
FIRM_S	0.1556	0.0841	1.8505	0.0642
LEV	-0.2557	0.7166	-0.3568	0.7212
C	-5.4552	1.0959	-4.9779	0.0000
McFadden R <sup>2</sup>	0.190882	Mean		0.553333

squared		dependent var	
S.D.dependent var	0.497978	S.E. of regression	0.446101
Akaike info criterion	1.172452	Sum squared resid	57.91082
Schwarz criterion	1.283566	Log likelihood	-166.868
Hannan-Quinn criteria	1.21692	Deviance	333.7356
Restr. deviance	412.4685	Restr.log likelihood	-206.234
LR statistic	78.73286	Avg. log likelihood	-0.55623
Prob(LR statistic)	0		
Obs with Dep=0	134	Total obs	300
Obs with Dep=1	166		

Source: Author's Source

The analysis in table 4.1 indicates a value of McFadden R-squared of 19.08% which implies that 19.08% of the variations of dividend decision are determined by selected board characteristics in Banking and Finance sector ; while the remaining 80.92% of variations are attributed to other variables. Out of 300 firm- year observations collected from 60 companies for 2012-2016 period, dividends were paid in 166 observations. As a percentage it is 55.33 %.

Table 4.2 depicts the results of logistic regression which aims to examine the impact of board characteristics on the likelihood of dividend payout taking into consideration six board characteristics and two control variables (Firm size and Leverage). As can be observed from the table, the firm's likelihood to pay dividends is affected positively by women on board, board size, CEO duality, board meetings and firm size. Audit committee size, Board independence, and Leverage showed a negative relationship with likelihood of dividend payout. Out of mentioned relationships, women on board, Board size and CEO duality have a significant positive relationship with likelihood of dividend payout at a significant level of 0.05. Positive impact of women on board and firm size were significant at 0.1 significance level.

### C. Panel Regression Results

Before running the panel regression researcher performed a “Hausman test” to decide whether to select fixed effects model or random effects model. The “Hausman test” can be used to differentiate between fixed effects model and random effects model in panel data. In this case, Random effects (RE) was preferred under the null hypothesis due to higher efficiency, while under the alternative fixed effects (FE) was at least as consistent and thus preferred. Since the probability value is 0.0588 for the mentioned test, null hypothesis was accepted under the significance level of 0.05. Thus random effect model was used to perform the regression analyses.

Table 4.2: Panel Regression Results - Banking and Finance Sector



Dependent Variable: DP

Method: Panel EGLS (Cross-section random effects)

Date: 04/19/18 Time: 21:57

Sample: 2012 2016 IF SECTOR=1

Periods included: 5

Cross-sections included: 44

Total panel (unbalanced) observations: 166

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AUD_S	0.0151	0.0139	1.0881	0.2782
BOD_G	-0.2346	0.1880	-1.2481	0.2138
BOD_I	0.0316	0.0114	2.7686	0.0063
BOD_M	0.0019	0.0059	0.3188	0.7503
BOD_S	-0.0236	0.0105	-2.2459	0.0261
CEO_D	0.4770	0.1356	3.5176	0.0006
FIRM_S	-0.0009	0.0140	-0.0672	0.9465
LEV	-0.1707	0.1118	-1.5273	0.1287
C	0.0555	0.1972	0.2816	0.7786

Source: Author's Source

The model possess adjusted R squared percentage of 8.49% which shows its explanatory power between board characteristics and the level of the dividend payout. Table 4.3 documented that dividend payout of firms listed in CSE is affected positively by AUD\_S, BOD\_I, BOD\_M and CEO\_D. Out of those variables BOD\_I and CEO\_D had significantly positive relationship with dividend payout at a significance level of 0.05. Dividend payout was negatively affected by BOD\_G and BOD\_S. Negative relationship of BOD\_S was significant at 0.05 significance level. There were no deviations from the overall regression analyses results with regards to direction of the relationships.

## V. CONCLUSION

The Dividend problem remained an unresolved conundrum since 1950s. The Researchers started finding a common answer for the question of why companies pay Dividends and the factors affecting for the payment of dividends. This research is based on finding out how Boards Characteristics, which is a main component of Corporate Governance has affected dividend policy. Furthermore the thesis has taken data based on previous 5 years, from 60 companies in Banking and Finance sector listed in the Colombo Stock Exchange.

In this paper, the dividend policy was measured using two dependent variables. Namely, Dividend Decision (whether dividend is paid or not) and, Dividend payout. The research is based on three analytical strategies which could be identified as Descriptive statistics, Binary Logistic Regression and Panel Regression.

With accordance to the results generated in Descriptive statistics, the 60 companies used for the study to fathom the average of the dividend payout for the last 5 years was 18.48%. Average number of non-executive directors in Audit Committee was 3 for all 11 sectors. Percentage of women on board depicted as 11.86% ranges from 0 to 0.375. This is a fine example to show that the Board Gender diversity is far less in Sri Lanka. Average board size was 8. The average financial leverage in Banking and Finance sector was 76%.

With respect to the Binary Logistic Regression results, the firm's likelihood to pay dividends is affected positively by women on board, board size, CEO duality, board meetings and firm size. Audit committee size, Board independence, and leverage showed a negative relationship with likelihood of dividend payout. Out of mentioned relationships, women on board, Board size and CEO duality have a significant positive relationship with likelihood of dividend payout at a significant level of 0.05. Positive impact of women on board and firm size were significant at 0.1 significance level.

According to the results generated in panel regression, documented that dividend payout of firms listed in CSE is affected positively by Audit committee size, Board independence, Board meetings and CEO duality. Out of those variables Board independence and CEO Duality had significantly positive relationship with dividend payout at a significance level of 0.05. Dividend payout was negatively affected by Board gender diversity and Board size. Negative relationship of Board size was significant at 0.05 significance level.

An unusual finding describes that Women on board positively affect for the likelihood to pay dividends but negatively affect the level of dividend payout. Which denotes that women directors support for the payment of dividends but in lesser amounts.

In a nutshell, mixed findings of this study support both outcome and substitution hypothesis. Outcome hypotheses suggests that managers in poor-governed firms are often interested in maximizing their own personal wealth, by paying no or low dividends to shareholders [8] whereas Substitution model proposes, firms with poor governance structures tend to pay larger dividends in order to establish a positive reputation with shareholders [8].

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# Re-engineering Sri Lankan Organizations: Role of ICT and Critical Success Factors

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**Abstract—** *It is a fact that business world and the technology are facing rapid changes. In consequence, it is required to respond rapidly to the changing demands in order to be in conformity with competitors and improving services, streamlining the business processes, minimizing the cost and uplifting the staff motivation etc. Most of the organizations face enormous difficulties in meeting challenges due to the inherent complexities involved in current business processes and procedures. The solution is process re-engineering. However, due to lack of maturity in this area, most of the organizations are in slow progress or abandoned their projects. Some have invested huge sums of money for Information and Communication Technology (ICT).*

*This project discusses the effectivity of enablers and inhibitors (Critical Success Factors) of the re-engineering and how the role of ICT influences the success of re-engineering projects. In this connection, selected 32 organizations/institutes from both in government and private sector were examined. During the pilot studies done at People's Bank, participation of workshops and seminars, discussions made with Re-engineering team leaders and literature survey, it was possible to find their approaches, role of ICT and concerned Critical Success Factors which have greatly influenced the re-engineering process in Sri Lankan organizations. As far as the role of ICT is concerned, efforts were made to find out how e-technology is incorporated in the 3 phases of reengineering process: before the process is designed, while the process is being designed underway and after the design is complete.*

*Based on this knowledge, conceptualize model was drawn and a structured questionnaire was prepared and distributed to more than 100 persons covering 32 organizations. Gathered information was analyzed in two ways such as basic and advanced analysis. In this scenario, more attention was made to analyze and highlight different views obtained from both in private and government sectors. These findings can be very vital to those who are planning re-engineering projects. Based on all these findings a set of recommendations were made which enable effective implementation of re-engineering projects in Sri Lanka.*

## I. INTRODUCTION: AN OVERVIEW OF RE-ENGINEERING

This study covers the broader subject area of organizational change in the process re-engineering. An overall background information relevant to the process Re-engineering focus on various views of different authors, various concepts about re-engineering and the reasons why Sri Lankan organizations go for re-engineering.

Due to the limitations of ICT facilities, capabilities and availabilities in the early stages, most of the re-engineering implementations were of a lower order. However during the last decade, with the growth of Internet, Web, Communication Technologies and more creative and

innovative applications fostered the re-engineering implementation at a higher order.

Risk associated with re-engineering projects, barriers to successful implementation, overview of ICT in process Re-engineering and overall ICT impact on the organizational change were discussed and more emphasize has been paid to elaborate on the ICT and its role in the three phases of re-engineering: Before the process is designed (as an Enabler), while the process is being designed, after completion the design (ICT as an Implementer).

A conceptual model was drawn and a structured questionnaire was prepared to obtain data from 32 organizations. Findings obtained from statistical analysis and the frequency distributed diagrams are described therein. There after recommendations were made accordantly.

## II. OBJECTIVES

### A. What is re-engineering?

According to Hammer and Champy re-engineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed. (Hammer and Champy ,1993)<sup>3</sup>.

### B. Aim and Objective of the Research

- Identify enablers and inhibitors (CSF) in the process Reengineering organization and how they impact during the process implementation of organizations.
- Identify the role of ICT in the re-engineering process and issues arising during the implementation.
- Identify why some re-engineering work fail or abandon in Sri Lanka.
- Identify how government and private sectors in Sri Lanka make progress in process re-engineering.
- Based on findings, make recommendations for successful re-engineering implementation in Sri Lanka.

## III. IT ROLES IN INITIATING AND SUSTAINING RE-ENGINEERING

Role of ICT in the three Phases is summarized in following table (Source: (Attarn, 2003) "Information Technology and BPR")

Before the process design	During the process design	During the implementation
Create infrastructures and manage information that supports evolving organization.	Bring vast amounts of information into the process.	Create a digital feedback loop.
Foster process thinking in organizations. Identify and select process for redesign.	Bring complex analytical methods to bear on the process.	Establish resources for critical evaluation of the reengineered process.
Participate in predicting the nature of change and anticipate the information needs to support that change.	Enhance employees' ability to make more informed decisions with less reliance on formal vertical information flows.	Improve IT processes to meet increasing needs of those divisions that have gone under reengineering processes.
Educate IT staff in non-technical issues such as marketing, customer relationships, etc.	Identify enablers for process design	Institute a program of "cleanup" and damage control in case of failure.
Participate in designing measures of success/failures of reengineering.	Capture the nature of proposed change and match IT strategy to that change. Capture and disseminate knowledge and expertise to improve the process.	Communicate ongoing results of the BPR effort. Help to build commitment to BPR.
	Communicate ongoing results of the BPR effort. Transform unstructured processes into reutilized transactions.	Evaluate the potential investment and return of reengineering efforts.

TABLE III. ROLE OF ICT

### A. Research Methodology

Three methodologies were used to analyze the information, ascertain the facts and make recommendations in the research study.

**Methodology 1** Using the collected information, draw frequency distributed diagrams and observed the behavior patterns. A plethora of observations were made accordingly made several recommendations.

**Methodology 2** Co-relational research methodology was used to determine the relationship

### C. Summary and Recommendation

It is recommended that following CSFs / areas should highly consider in the process re-engineering in the Sri Lankan environment.

- Sustain the support and continuous commitment of top management.
- Specially, government sector must place more attention on identifying the core processes.

between the Critical Success Factors and evaluation criteria of successful re-engineer projects.

**Methodology 3** The Non- parametric research methodology was recommended, as it is the best according to the data sets. Therefore, this research methodology was selected to determine how these CSFs significantly affect the evaluation criteria of successful re- engineering projects.

### B. Reasons for the failures and slow progress of re-engineering projects in Sri Lanka

- Not strongly concerned with identification of core business processes.
- Less consideration of Project Management.
- Top management support getting low in the implementation of re-engineering projects and they rarely get emotionally involved.
- Lack of monitoring and evaluation procedures in project performance.
- Reliance on individuals and not teamwork.
- Investment of funds to obtain ICT facilities before proper identification of core processes.
- Unwillingness and reluctance to change the pattern of work.
- Lack of understanding amongst operational managers.
- Obstacles / impediments in applying ICT support systems.
- No clear structural method is inbuilt to the programme of PR.

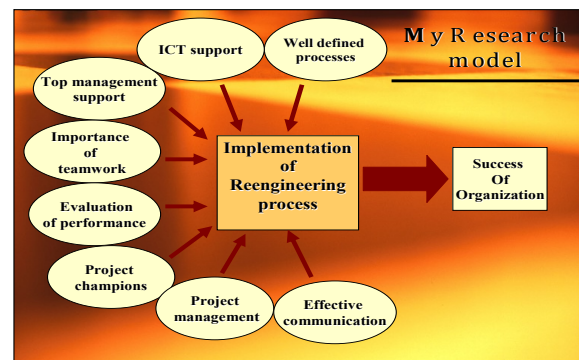


Fig. 4. Research Model

- Improve project management skills and activities until the success of projects.
- Appoint highly skilled project champions in different processes in the project.
- Improve teamwork and members skills with continuous relevant training, arranging workshops and awareness programmes etc.
- Continuous evaluation process of monitoring the performance must be incorporated to the project.
- Effective communication and continuous feedback system should be maintained with team members and all affected user levels.

- h. Acquire ICT facilities after proper identification of core processes and cross-functional areas of the project.
- i. A special component should be incorporated in organizations with the aim of minimizing phobia of employees by enhancing their knowledge and skills and streamlining the PR activities.

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# Data Mining Approach to Analysis and Prediction of Movie Success

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**Abstract—** Data mining is a very efficient approach to uncover information which will both confirm or disprove common assumptions about movies, and it also allows us to predict the success or failure of a future movie using the known information about the particular movie before its release. The main aim of this study is to analyze data mining approaches to explore the attributes affecting the success or failure of a movie. Each and every data mining algorithm provides separate prediction accuracy details. This study integrates four data mining algorithms (Decision Trees, Naïve Bayes, Support Vector Machine, Neural Networks) and an Ensemble approach in order to address the intriguing problem of the movie success prediction and also demonstrates the correlation between success or failure of a movie and different attributes of movies like Opening weekend Gross, Sequel, Theaters, Budget, Genre, Distributors, Country, IMDB Rating, MPAA Rating, Run Time etc. The prediction performance of these models has been evaluated using Accuracy, Precision, Recall, F-Measure, MCC, ROC Area, PRC Area, Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE) etc. Further, a spatial clustering technique called the Associated Keyword Space (ASKS) was applied for this study, which is effective for noisy data and projected clustering result from a three-dimensional(3D) sphere to a two dimensional(2D) spherical surface for 2D visualization. Similarities between movies were calculated using the Cosine Similarity and these affinity values were used for this clustering model. Movies were categorized under the success or failure of movies by clustering them into four clusters as Most Successful Movies, Successful Movies, Unsuccessful Movies and Least Successful movies. Experimental results show the most effective attributes towards the success or failure of a movie out of these movie attributes considered in this study. Moviemakers can use these results to identify which movie attributes are the most effective and can consider them for the success of their future movie productions. Also, using the Correlation Coefficient, a mathematical model that can be used to predict the movie's success or failure is proposed in this study.

**Keywords—** decision tree, naïve Bayes, neural networks, support vector machines, ensemble, spatial clustering

## I. INTRODUCTION

The process of movie making is both an industry and an art. Movies are a great source of entertainment and people are crazy about movies. Every year movie industry produces thousands of movies of different genres [1]. There are many online platforms that keep track of movies like Box Office Mojo (BOM), Rotten Tomatoes, and Internet Movie Database (IMDB), which provide information about movies such as actors, directors, budget, as well as user ratings and comments, which provide fair information about movies. There is a great deal of uncertainty that the movie will do business or not [1]. The movie industry is a big business, which can give profits or loss up to several million dollars [2]. Moviemakers are still never sure about whether their movie will do business or not; when they should release the movie and how to advertise it [1] [3]. Most of the time, people are not sure about which particular movie to look for so that their spare time is utilized in entertainment.

Being able to predict into the future is of great importance in decision-making, playing a key role in many areas of science, medicine, finance and industry [4]. If there is a way to predict the percentage of success of movie which is yet to be released and predict a movie being a hit or flop in terms of various parameters such as language, country, budget etc., it is very important for everyone involved in the movie such as cast, directors, producers, investors, other artists and also the audience.

Data mining algorithms are generally based upon the notion of finding trends, patterns or anomalies in a set of data, and could be beneficially used for identifying the most contributed attributes towards the success or failure of a movie and predicting the success or a failure of a movie.

## II. LITERATURE REVIEW

For the prediction of movies, different types of researches have been carried out by using different approaches by using news, articles, blogs, and social media etc. But very few researchers have explored through attributes related to a movie.

S. Asur and B. Huberman [5] used data from social media and employing sentiment analysis to predict the future of movies in terms of its business (box office revenue). Another research [6] presents the prediction of the popularity of a movie by the articles on Wikipedia. Another research [7] presents predicting the gross of movies using the news

articles as well. Their results suggest that they can achieve better performance by using the combination of IMDB data and news data. Reference [3] used movie data from IMDB, Rotten Tomatoes and Wikipedia and applied machine learning algorithms like linear regression, SVM regression and logistics regression.

Some [2] have studied attributes like MPAA ratings, sequel and genre that affect the box office revenue of movies, but however, they did not get sufficiently accurate results. And also, they failed to consider social media as one of the parameters in their forecasting model. Another research [8] is conducted to predicting the numerical user ratings of a movie using pre-release attributes such as its cast, directors, budget and movie genres. Their aim is to evaluate the prediction performance of random forests in comparison to support vector machines. Both algorithms show great similarities in terms of their prediction performance, making it hard to draw any general conclusions on which algorithm yield the most accurate movie predictions.

Yoo et al. [9] predict the movie revenue from movie data collected from IMDB. This study fails to give sufficiently precise results to be used in practice. There is a research [10] that predicts revenue of movies using reviews on blogs and critical reviews by practical critics but not using social media.

In this paper, this study differs from others as follows. First, there is no reported study that compares the performance between various data mining algorithms to find out what provides the best accuracy for predicting the success or failure of a movie and correlation of the attributes that affects the movie's success/failure. This study seems to be the first modern attempt of its kind in this problem domain that compares the data mining classifiers using the accuracy, correlation, precision, recall etc. This research investigates the application of data mining algorithms such as Decision Trees, Naïve Bayes, SVM, Neural networks, Ensemble etc. to predict the success of movies prior to release and to introduce a simple solution for predicting success of movies in terms of various parameters such as opening weekend gross, distributor, released month, genre, runtime, MPAA rating, budget, theaters (no of screens) and sequel etc. The predictions are based on historical data collected from Box Office Mojo, IMDB, Rotten Tomatoes, and Wikipedia. The predictions are then evaluated and compared in order to find those which provide the best and most accurate performances. Here this study intends to find the issues within these classifiers and introduce a new, more accurate algorithm that overcomes those issues to make the most accurate predictions and a mathematical model for predicting the success/failure of a movie. And also this study hopes to conduct a study on the movies used here, using Euclidean Distance, Similarity and Correlation etc. Movie clustering is used here to discover movies efficiently by providing a visualization of movie data. This is used to compare and evaluate the movie in terms of their similarities, distances and correlations between movies. And also a mathematical model is introduced here for predicting a movie being a success or a failure.

### III. METHODS

The objective of the project is to analyze different attributes that affect the success or failure of movies from various sources available on the Internet and to predict the success or failure of the movies based on various criteria using different data mining algorithms (classifiers) and to study the similarities and distances between movies. Fig. 1 shows the flow of various processes for analysis.

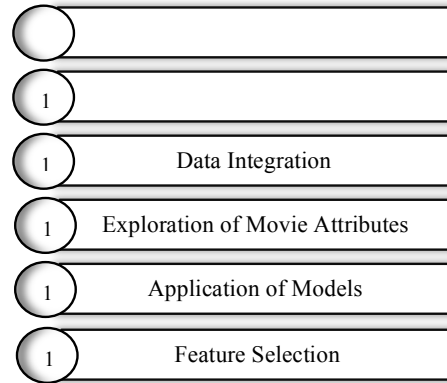


Fig. 1. Process Flow Diagram

#### A. Data Collection

For this study, there was no public dataset available which had all of the attributes that are deemed to be necessary for predicting movie successes. In order to properly evaluate the relevant data mining algorithms on movie success or failure predictions, a number of relevant datasets have to be considered for the experiment. Therefore, different options for acquiring the data needed were considered. Main sources of data were IMDB, Rotten Tomatoes, Box Office Mojo (BOM) and Wikipedia. About 200 movies that were released in 2017 were considered.

#### B. Data Preprocessing

The data extracted from the various sources need to be cleaned as the data was obtained from multiple sources. The data was inconsistent, missing and very noisy as well. The Central Tendency was used as a standard for filling missing values for attributes, to cater to missing fields' issue [3]. The collected data were stored in .csv files, with all the attributes and information that are linked to the movies' success or failure for the study.

#### C. Data Integration

The data extracted from Box Office Mojo, IMDB and other sources need to be integrated and transformed so that it can be used for analysis and classification purposes. Using the .csv files as my source, the selected attributes were transformed into a format to facilitate mining, and produce database queries to select the data to be mined. Here, the data were grouped into a separate .csv file with only the required attributes that have an impact on the success or failure of a movie.

#### D. Exploration of Movie Attributes

Following attributes given in TABLE I and TABLE II, which affect the success or failure of movies, were considered for this study. Here values were categorized into groups for ease of analysis.

TABLE I  
SUMMARY OF INDEPENDENT ATTRIBUTES

Name of Attribute	No. of Values	Values
Opening Weekend Gross	9	Numeric values(1,2,3,4,5,6,7,8,9)
Total Worldwide Gross	9	Numeric values(1,2,3,4,5,6,7,8,9)
Total Profit	9	Numeric values(1,2,3,4,5,6,7,8,9)
Country	21	USA, Russia, India, China, Germany, Thailand, Norway, France, Turkey, Iran, Nigeria, South Korea, Netherlands, Australia, Israel, Belgium, Mexico, Brazil, Japan, Vietnam, Indonesia
Genre	20	Action, Adventure, Thriller, Horror, Biography, Crime, Drama, Horror, Comedy, Fantasy, Animation, Mystery, Musical, War, Documentary, Romance, Sci-Fi, Family, Sport, Short
Sequel	2	Sequel, Not Sequel
Budget	9	Numeric values(1,2,3,4,5,6,7,8,9)
Theaters (No of Screens)	3	Numeric values(1,2,3,4,5)
IMDB Rating	4	Terrible, Poor, Average, Excellent
MPAA Rating	5	R, PG, PG-13, G, NR
Release Month	12	Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Runtime	4	Too Long(TL), Long(L), Short(S), Too Short(TS)
Distributors	44	BV, Sony, WB, WB(NL), Uni., Fox, Par., LGF, TriS, LG/S, STX, Focus, ENTMP, A24, Wein, FoxS, PNT, Aviron, SGem, ORF, BST

TABLE II  
SUMMARY OF THE CLASS ATTRIBUTE

Name of Attribute	No. of Values	Values
Success/Failure	2	Yes(Y), No(N)

#### E. Application of Models

There are many data mining tools available. WEKA (Waikato Environment for Knowledge Analysis) and MATLAB were used for the experimentation. This paper mainly focused on comparing the performance of each data mining algorithm (classifier) to determine whether each movie would be a success or a failure and find out the correlation of the attributes towards the success or failure of movies. Following classifiers shown in TABLE III were selected for the experimentation.

TABLE III  
LIST OF CLASSIFIERS

Classifiers
-------------

Decision Tree
Naïve Bayes
Support Vector Machine (SVM)
Neural Networks
Ensemble (Voting)
Spatial Clustering (Associated Keyword Space – ASKS)

1) *Data Mining Algorithm Comparison:* Decision Tree (J48), Naïve Bayes, Support Vector Machine, Neural Networks were evaluated and compared to find out the classifier with the best prediction performance based on various prediction criteria such as Prediction Accuracy, Precision, Recall, F Measure, MCC, ROC Area, PRC Area, RMSE and MAE values etc.

2) *Ensemble Approach:* Ensemble approach that combined the predictions from multiple models was used to increase the prediction accuracy. Different ensemble techniques were used such as Bagging, Voting, Boosting, and Stacking.

3) *Clustering Approach:* A spatial clustering technique called the Associated Keyword Space (ASKS) was used to plot similar movies into the same area allowing us to search movies by visualization of the movie data on a spherical surface. The movie similarities were calculated using Cosine Similarity method to get the affinity matrix. Following Equation (1) is used to integrate the features of movies to compute the final similarity value Similarity ( $M1_i$ ,  $M2_i$ ) between movies  $M1$  and  $M2$ . Given two vectors of attributes,  $M1$  and  $M2$ , the cosine similarity,  $\cos \theta$ , is represented using a dot product and magnitude as,

$$\text{Similarity} = \cos \theta = \frac{M1 \cdot M2}{\|M1\| \|M2\|} = \frac{\sum_{i=1}^n M1_i M2_i}{\sqrt{\sum_{i=1}^n M1_i^2} \sqrt{\sum_{i=1}^n M2_i^2}} \quad (1)$$

#### F. Feature Selection

To do the attribute ranking according to their contribution towards the success or failure of a movie, Feature Selection Process was done using various feature selection techniques such as InfoGainAttributeEval, GainRatioAttributeEval, CorrelationAttributeEval.

## IV. RESULTS AND DISCUSSION

This section discusses the results obtained from the analysis. The experiments were conducted on Microsoft Windows 7, Intel Core i3-3110M, 2.40 GHz and 4GB RAM. Data were gathered from Box Office Mojo, IMDB, Rotten Tomatoes, and Wikipedia. The manual classification was performed in order to categorize the movie data set to compare the results. MS Excel was used for data storage and classification. WEKA and MATLAB were used for the analysis.

#### A. Result 01— Classifier Evaluation & Comparison



Following TABLE IV shows how each algorithm performance according to their accuracy, precision, recall, F-Measure, MCC, ROC Area, and PRC Area, RMSE, MAE etc.

TABLE IV  
OVERALL ALGORITHM CLASSIFICATION RESULTS

Classifier	Decision Tree	Naive Bayes	SVM	Neural Networks
Measure				
Accuracy	71.42 %	76.62 %	89.61%	86.66 %
Precision	0.733	0.775	0.898	0.867
Recall	0.714	0.766	0.896	0.867
F Measure	0.716	0.768	0.896	0.867
MCC	0.443	0.535	0.790	0.700
ROC Area	0.724	0.870	0.898	0.760
PRC Area	0.669	0.878	0.858	0.782
RMSE	0.4429	0.388	0.3223	0.3643
MAE	0.3923	0.2679	0.1039	0.1826

The results obtained from each of the classifiers are shown above in TABLE IV. These results show the percentage of time that the experiment was able to correctly predict the instances. Highest accuracy with SVM which is 89.61 % was achieved. Decision Tree, Naïve Bayes, and Neural Networks produced an accuracy of 71.42 %, 76.62 %, and 86.66 % respectively. Ensemble approach that was used to increase the movie prediction accuracy produced an accuracy of 92.85 %.

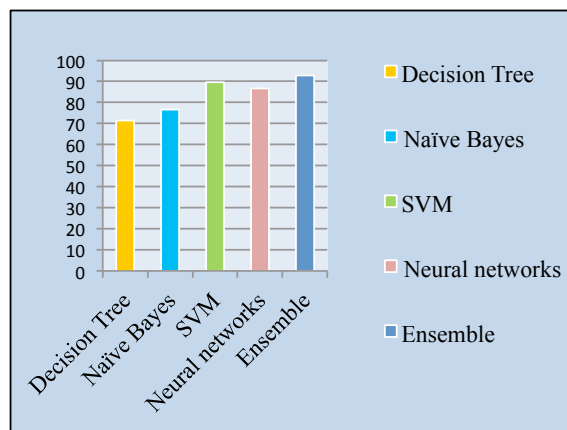


Fig. 2. Overall Comparisons of Data Mining Algorithms

### B. Result 02— Clustering Approach

A program that returns similar movie list for a given input movie was implemented. Benchmark of 200 movies released in 2017 was selected as the test data set. Fig. 3 shows the result of spatial clustering approach.

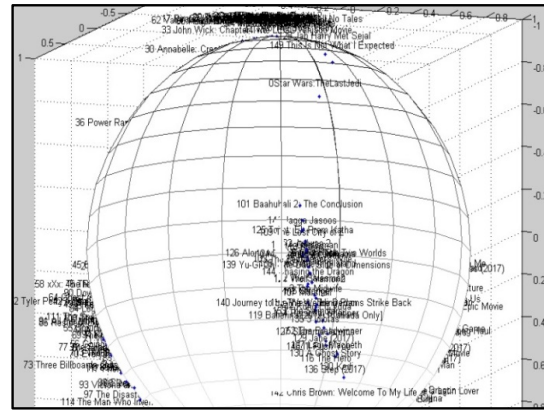


Fig. 3. Result of spatial clustering and visualization

ASKS plotted similar movies into the same area allowing us to search movies by visualization of the movie data on a spherical surface.

On the spherical surface, the movies are distributed according to their similarity. When analyzing the spherical surface, four main regions were identified; Most Successful Movies, Successful Movies, Unsuccessful Movies, Most Unsuccessful movies, where movies are placed and the results show that similar movies in the same domain are placed into one region. Clear separation of regions and density variation of movies within the region that can be considered these regions as movie clusters were observed.

Highlighted areas in Fig. 4 (a) show some similar movies. Fig. 4 (b), Fig. 4 (c) and Figure 4.7 (d) show parts of Most Successful Movies, Successful Movies and Unsuccessful Movies clusters respectively.

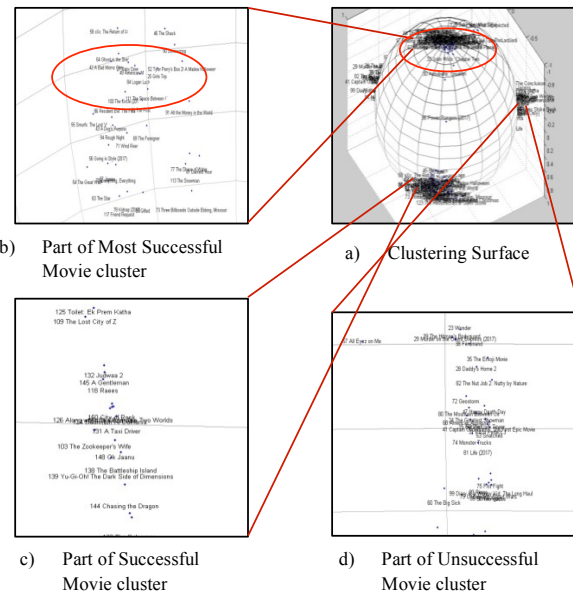


Fig. 4. Result of spatial clustering and visualization

Moreover highlighted area in Fig. 4 (b) shows that more similar movies are placed in the same area within the cluster. For example “Star Wars: The Last Jedi” movie is placed

inside the cluster more closely to the “Beauty and the Beast (2017)” movie than “Power Rangers (2017)” movie.

As the next step of the evaluation procedure to evaluate the performance of the affinity calculation method which uses Cosine Similarity, affinity values were calculated using these similarity values. Here also four main regions were observed, but when further analyzing the clustering region, observation shows that some correctly clustered movies in cosine similarity method are incorrectly placed within the clustering surface.

### C. Result 03—Mathematical Approach

The attributes were given weightages according to the results of the analysis. Attributes were ranked, according to the Feature Selection Process. The weightages were calculated and assigned to each attribute according to their contribution towards the movie success prediction. The prioritized values were given to each group of each attribute according to their contribution towards the success or failure of movies.

TABLE V  
WEIGHTAGES & PRIORITIZED VALUES GIVEN TO ATTRIBUTES

Attributes	Rounded Weightage	Prioritized Values
Opening Weekend Gross	0.23	0,1,2,3,4,6,7,8
No of Theaters	0.23	0,1,2,3,4
Sequel	0.20	0,1
Country	0.10	0,1,2,3,4,5,6,7,8, 9,10,11,12,13,14, 15,16,17,18,19,20
Distributor	0.56	0,1,2,3,4,5,6,7,8, 9,10,11,12,13,14, 15,16,17,18,19,20
Budget	0.05	0,1,2,3,4,5,6,7,8
Genre	0.04	0,1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16
IMDB Rating	0.03	0,1,2,3
Release Month	0.03	0,1,2,3,4,5,6,7,8,9,10,11
MPAA Rating	0.02	0,1,2,3
Run Time	0.01	0,1,2,3

A new mathematical way to calculate the percentage of the success of a movie in terms of selected attributes of movies was introduced here. This is a linear mathematical equation.

$$y = \sum_{i=1}^{11} x_i \times w_i$$

$$y = x_1 \times w_1 + x_2 \times w_2 + x_3 \times w_3 + x_4 \times w_4 + x_5 \times w_5 + x_6 \times w_6 + x_7 \times w_7 + x_8 \times w_8 + x_9 \times w_9 + x_{10} \times w_{10} + x_{11} \times w_{11} \quad (3)$$

where  $x_i$  ( $i = 1,2,3,\dots$ ) is the prioritized value of each attribute and  $w_i$  ( $i = 1,2,3,\dots$ ) is the weightage given to each attribute.

If  $(\frac{y}{y_{max}} \times 100) > 50\%$ , then the movie is predicted as a success and otherwise, it is predicted as a failure.

This mathematical model provides a prediction accuracy of 85 % – 90 %. This model is quite simple but still powerful enough to make good predictions.

## V. CONCLUSION

This study using a Data Mining approach aims to introduce a new model for predicting a movie's success or failure considering a number of attributes related to that movie. Data mining algorithms were compared and evaluated. SVM produces the highest movie prediction accuracy of 89.62 % and as expected the Ensemble approach increases the accuracy up to 92.85 %. Opening Weekend Gross, Sequel and No of Theaters were identified as the most contributed attributes towards movie success prediction. It is clear that a movie's success is determined by much more than obvious attributes such as genre. Clustering approach provided a 3D visualization of movies, useful in comparison of movies. The proposed mathematical model for predicting the success or failure of movies is powerful enough to make good predictions with a prediction accuracy of 85 % – 90 %.

Movie makers can use these results to identify which movie attributes are the most effective and can consider them for the success of their future movie productions. All the people who are involved in a movie can use this predictor to do the predictions prior to its release.

## VI. RECOMMENDATION

This research shows promise for further development in this area. The prediction performance of data mining algorithms and the performance of the clustering approach can be improved by considering new attributes that may affect the movie success or failure. More data mining classifiers can be tested against the results of the used classifiers in this study. Experiments will be carried out to increase the performance of movie discovery and comparison by using visualized movie clusters. Comparison of the movies can be improved using more clustering approaches as well. Prediction performance of the mathematical model can be improved considering the attributes that were not discussed.

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# Remuneration Outcomes of Internal Migrants in Indonesia: A Quantile Regression Approach

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**Abstract**—internal migration is a common livelihood strategy undertaken by the poor within a nation in an attempt to improve their economic standing. However, many are argued to get trapped in the low paying informal sector employment. To date many studies have investigated whether migrants improve their income upon migration. In the Indonesian context, research suggests that internal migrants earn a higher wage than urban non-migrants. However, observing wages over time is insufficient to understand the complete situation of migrants in the labour market. The present study is an attempt to provide a better understanding about migrants' economic assimilation by examining the total compensation package (monthly salary, value of in-kind benefits) across the distribution. For this purpose data on Indonesian internal migrants and non-migrants from the Rural-Urban Migration in Indonesia (RUMiI) Project from year 2008 and 2009 is used to gain insight into the fragmented nature of the urban labour market in the four Indonesian cities included in the dataset. Initial findings from Ordinary Least Square (OLS) regression analysis suggest that migrant's (both rural-urban and urban-urban) receive better compensation packages in comparison to their urban non-migrant counterparts. Moreover, it appears that in Indonesia the extent of job informality is an important determinant of the value of the remuneration package received by workers, where both rural-urban and urban-urban migrants are penalized for working in informal sector employment. When moving beyond mean regression estimates, the Quantile Regression (QR) suggests that earnings premiums are visible mostly in the lower end of the earnings distribution. Further, the informality penalty is larger at the lower end of the remuneration distribution.

**Keywords**— *internal migrants, informality, remuneration, quantile regression*

## I. INTRODUCTION

Migration has existed for decades as a mechanism of improving livelihoods, and research in this area has gained momentum due to the recognition of its developmental impact [1]. Rural-urban migration in Indonesia started to increase between 1970 and 1980 due to a number of economic reforms which attracted foreign investments in resource extraction, exports, garments and footwear industries creating more employment opportunities in cities. Migrants flowed into urban areas to seize these opportunities [2] and by 2005, 20% of the Indonesian urban population consisted of migrants [3]. Given these trends it is of interest to know whether migrants who move into the city in search of greener pastures fare better upon migration. In this regard, most studies focus on labour market outcomes of migrants, whereby they compare rural-urban migrants' earnings to that of non-migrants [3-5]. In Indonesia, evidence suggests that internal migrant's earnings seem to be slightly higher than that of non-migrants [3] and the longer they stay in the city the more they earn than non-migrants [5]. Nevertheless, it is

not clear whether this favourable economic outcome is a tradeoff for working in less pleasant occupations with fewer benefits.

In fact, when studying the labour market outcomes of internal migrants it needs to be studied in the context of the segmented urban labour market [6], especially in a developing country like Indonesia where up to 68% of Indonesians were employed in the informal sector in 2009 [7]. It is important to consider that rural-urban migrants may get trapped in the informal sector until job opportunities open up in the formal sector [8]. Accounting for this possibility is vital as whether migrants end up in the formal or informal sector has important implications on their wage outcomes.

Further, research to-date on Indonesian migrants' wages has been conducted using conditional mean regressions, which reveal how covariates relate to the dependent variable around the mean [3, 5]. However, there are studies carried out in the context of international migration (Chiswick et al., 2008) and internal migration [9, 10] which point out that the effect of covariates on the outcome variable differs across the wage distribution. Therefore, it is worthy to examine whether the migrant outcomes at the mean remain same across the remuneration distribution as well.

Thereby this research aims to contribute to the existing literature in two main ways: firstly, by answering the question how migrants fare in relation to labour market outcomes when considering both wage (monthly earnings and bonus value) and non-wage (value of in-kind benefits) aspects of the remuneration package. Secondly, it examines whether economic outcomes of Indonesian internal migrants remain same across the remuneration distribution. For this purpose survey data from the year 2008 and 2009 Rural Urban Migration in Indonesia (RUMiI) project is used.

Section one provided a background of the research setting and the rest of the paper is organised as follows; section two will provide a review of the literature on labour market assimilation of internal migrants, particularly in Indonesia, section three will provide details on the data, sample characteristics, variables and methodology used in the study. Findings will be discussed in section four. Finally, section five will summarise the key findings.

## II. LITERATURE REVIEW

When considering the empirical research conducted in relation to internal migration, most focus on migrant labour market outcomes since migration is usually undertaken as a mean of socioeconomic mobility and labour market outcomes are used as proxies to measure migratory outcomes. Past studies suggest that assimilation of internal migrants largely depends on migrant characteristics [11, 12], distance moved and the economic conditions which exist in the destination labour market [13]. Studies based on various developing nations such as Thailand [14], Ethiopia [15], India [16] and Egypt [17] all point towards the importance of human capital as a factor which allows internal migrants to earn higher than urban natives over time. In fact, education and experience in the city seems to play a complementary role according to findings from Thailand [14]. These findings suggest that despite the common perception of poor and less endowed migrants, migrants in certain developed and developing countries seem to have higher levels of education and tend to earn higher wages than non-migrants.

Early studies based on Indonesia claim that education as in other developing countries played an important role on migrant outcomes [4]. Moreover, it appeared that the motivation to migrate diminished with age, where those less-educated either migrated early or remained in the rural areas. Speare and Harris find that males in self-employment and working for others earned higher income contrary to the common belief that those in traditional formal sector earned highest incomes [4]. However, the study did not find any statistically significant relationship between migration propensities and earnings differentials across regions, which is explained to be a consequence of migration driven by rates of job creation rather than by earnings differentials across regions. Therefore the higher propensities of the educated to migrate are related to the location of job openings rather than wage differentials across regions. Alternatively, it may reflect the positive aspects of urban jobs and urban residence that are not reflected in the current salaries- i.e. higher social status and other urban facilities. In fact, a more recent study conducted by Lottum and Marks also found that despite the common belief that wage differentials motivate migration from less developed to more developed areas, in Indonesia this does not seem to be an important determinant of interprovincial migration possibly due to the dual labour market observed in Indonesia where most migrants end up in the informal sector [18].

Other recent studies on internal migration and labour market outcomes of migrants in Indonesia were conducted by Frijters et al. [3] and Manning and Pratomo [5]. Both studies use RUMiCI data, the former using data for year 2008 and later using data for year 2009. Frijters et al. find that in China occupational barriers are able to explain about 20% of

the wage differential, whereas in Indonesia the slightly higher wages of migrants are mainly due to their over-representation in higher-paying occupations and longer working hours [3]. There seems to be no evidence of discrimination in Indonesia because wages and occupational distribution of rural migrants and urban non migrants seem to be very similar as opposed to the case in China. Manning and Pratomo furthers the understanding of labour market outcomes of Indonesian internal migrants by analysing outcomes by the time duration migrants have resided in the city, whereby migrants are classified as very recent migrants (VRM), recent migrants (RM), long-term migrants (LTM) and non-migrants (NM). From their multinomial logit analysis it is evident that there is a greater probability of being employed in the informal sector if an RM, whereas LTM's are more likely to be employed in the formal sector, and move into higher paying segments of the economy [5]. Moreover, the study revealed that LTM receive higher wages than all other groups due to their experience in the urban labour market proving that city work experience increases the wages due to their ability to adapt to the urban environment. Overall, the findings of Frijters et al. [3] and Manning and Pratomo [5] complement the notion that the freer migration policies in Indonesia have benefited migrants compared with migration within a tightly controlled system. Nevertheless, there is no evidence regarding whether these favourable labor market outcomes are a reflection of a tradeoff for working in less pleasant occupations. There is also no evidence of whether these internal migrants' economic outcomes remain consistent across the remuneration distribution.

## III. DATA, VARIABLES AND METHODOLOGY

### A. Data

Survey data from year 2008 and 2009 RUMiI project is used to answer the research questions in section one. The survey data represents four main regions in Indonesia which attracted a large number of migrants; (1) Sumatra; (2) Java and Bali; (3) Kalimantan; and (4) Sulawesi, Papua, Maluku and Nusa Tenggara (Eastern Indonesia). Samples were drawn from cities which had large communities of migrants in each region: Medan in Sumatra, Samarinda in Kalimantan and Makassar in Eastern Indonesia. The exception was Tangerang in Java, which had a smaller number of rural-urban migrants than some Jakarta municipalities, but Tangerang was considered a good substitute as most of its residents worked in Jakarta (Resosudarmo et al., 2009). For the purpose of this study, data on demographic characteristics and information on the wage and non-wage aspects of the remuneration package of both migrants and non-migrants are used.

Salaried employees who were between 16-60 years of age, reporting a positive figure for monthly earnings were selected. Individuals of age group 16-60 years were selected since 16 is the official age above which individuals are considered to fall under the working age group and the upper age limit of 60 is selected because in Indonesia the retirement age varies between 55-60 years depending on the

firm you are employed in [19]. Moreover, only those in salaried employment are considered for the study as self-employed and civil servants are a distinct set of individuals, and the wage determination in these sectors is different. For instance, wages in self-employment may not reflect productivity in the same way as wages in salaried positions do and wages and benefits in the Government sector are set in a uniform manner according to the rank of employees [20].

#### B. Variables

The dependent variable used in the estimations  $\ln(y_{it})$  represents the log value of the full remuneration package which is derived through combining the monthly income, bonus value (yearly bonus value divided by 12 in order to get the per month value) and the value of in-kind benefits. The value of in-kind benefits are derived from summing up the monthly value of meals, accomodation and transportation provided by the employer. The total value of this monthly full remuneration package is then log transformed before analysis.

An individual's monthly log-remuneration package  $\ln(y_{it})$ , is assumed to be determined by a number of observable characteristics as represented by vector  $x_{it}$  (age, age square, education, gender, marital status, industry of employment, the destination city and log hours worked per month), migrant status ( $Mr_{it}$ , for rural-urban migrants and  $Mu_{it}$ , for urban-urban migrants) and  $u_{it}$  unobserved characteristics. Further, an interaction term between migrant status and informal sector employment is included. Informality ( $I_i^S$ ) is defined using a firm size method as per Sharma (2010). Any firm employing more than 10 employees is defined to be formal, because in Indonesia, all firms employing more than 10 employees are legally bound to make social security contributions [20].

#### C. Methodology

The study initially uses an Ordinary Least Square (OLS) estimation strategy, followed by a quantile regression (QR) approach. The OLS models are as follows, where equation 1 represents the model for rural-urban migrants and equation 2 is for urban-urban migrants.

$$\ln(y_{it}) = \beta_0 + x_{it}\beta_1 + \beta_2 Mr_{it} + \beta_3 I_{it}^S + \beta_4 Mr_{it} * I_{it}^S + u_{it} \quad (1)$$

$$\ln(y_{it}) = \beta_0 + x_{it}\beta_1 + \beta_2 Mu_{it} + \beta_3 I_{it}^S + \beta_4 Mu_{it} * I_{it}^S + u_{it} \quad (2)$$

$$\ln(y_{it}) = \beta_0 + x_{it}\beta_1 + \beta_2 Mu_{it} + \beta_3 I_{it}^S + \beta_4 Mu_{it} * I_{it}^S + u_{it}$$

To further enrich the analysis, this research employs a QR approach for equation 1 and 2 above. Quantile regression helps to unmask any differences which exist in the lower and upper tails of the earnings distribution as it models the conditional distribution of the dependent variable as a function of the observed covariates [21]. This technique helps to understand how certain percentiles of the remuneration package may be affected more by certain variables than others (as reflected by the change in the size of

the regression coefficient). Furthermore, it provides results which are capable of handling extreme value points and outliers [22].

#### IV. RESULTS AND DISCUSSION

Results in table 1 indicate that both rural-urban and urban-urban migrants attract an earnings premium even when considering a more complete version of the remuneration package. These finding complement the existing literature on Indonesian internal migrants using RUMiCI data [3, 5]. Working in informal sector jobs appear to have a penalising effect on the log monthly earnings. These findings are consistent with policy reports based on Indonesia, where the Asian Development Bank (ADB, 2010) provides evidence that individuals in informal employment earn less than those engaged in formal employment. Similarly, also shows that although informal jobs may be preferred by some, informal workers earn less and usually do not receive benefits associated with the formal sector employment [23].

It seems that the effect of informal sector employment on earnings outcome does not depend on the migrant status as indicated by the insignificant interaction term between informality and migrant status. When observing other covariates, they suggest that males earn more than females. Moreover, the results highlight the importance of human capital as embodied in job tenure (reflecting experience) and education. Where the more experienced and more educated individuals are, they receive better remuneration packages [6, 20]. It is evident that the better remuneration packages are set off by longer working hours.

REMUNERATION DETERMINANTS

Dependent Variable: Log monthly remuneration		
	Rural-urban migrants	Urban-urban migrants
Male	0.2313*** (0.0256)	0.2359*** (0.0300)
Age	0.0215** (0.0092)	0.0076 (0.0106)
Age squared	-0.0003** (0.0001)	-0.0001 (0.0001)
Job tenure	0.0145*** (0.0022)	0.0155*** (0.0026)
Educational level	0.1640*** (0.0092)	0.1779*** (0.0105)
Log (hours worked)	0.2763*** (0.0416)	0.2614*** (0.0470)
<b>Marital status dummy(Single=0)</b>		
Married	0.1059*** (0.0335)	0.1363*** (0.0400)
Divorced	0.1339 (0.1201)	0.2007* (0.1174)
Widow/widower	0.0146 (0.1209)	0.0479 (0.1220)
<b>Industry dummy (Manufacturing = 0)</b>		
Agriculture	-0.2986** (0.1385)	-0.3505*** (0.1446)
Mining	0.3213*** (0.0841)	0.4434*** (0.0974)

Construction	0.0290 (0.0383)	0.0419 (0.0454)
Services	-0.0825*** (0.0267)	-0.0957*** (0.0293)
<b>City dummy (Tangerang = 0)</b>		
Medan	-0.1428*** (0.0289)	-0.1208*** (0.0323)
Samarinda	0.0290 (0.0324)	0.0429 (0.0383)
Makassar	-0.1661*** (0.0349)	-0.1685*** (0.0416)
<b>Migrant status (Non-migrant = 0)</b>		
Rural-urban migrant	0.2550*** (5.00)	
Urban-urban migrant		0.0938*** (0.0340)
<b>Informality</b>	-0.1377*** (0.0335)	-0.1317*** (0.0338)
<b>Informality*migrant status</b>	0.0468 (0.0488)	-0.0077 (0.0620)
Year dummy (year 2008=0)	0.0792*** (0.0221)	0.0905*** (0.0250)
Constant	11.1482*** (0.2715)	11.3872*** (0.3052)
No. of observations	2786	2295
R-square	0.2932***	0.2984***

Source: RUMil data, year 2008 & 2009  
Note: \*\*\*, \*\*, \*, denotes significance at 1%, 5% and 10% respectively. ( ) t statistics. Robust standard errors reported.

When looking at industry effects, those who are in the mining sector seem to be consistently earning more than those who are employed in the manufacturing sector. On the other hand, workers in the agricultural and services sector earn less than those who are employed in the manufacturing sector. Moving on to the city effects, there are variations in remuneration packages across cities, whereby, those in Medan and Makassar seem to receive remuneration packages which are lower in value than those received by respondents working in Tangerang, which is expected given that Tangerang is a city in the island of Java, which is considered to be the economic core of Indonesia [18]. This disparity may be reflective of the cost of living differences across cities, where Tangerang has a higher cost of living than the other cities included. However, those working in Samarinda seem to receive a remuneration package on par with those in Tangerang.

Results in Table 2 examines whether the results observed in the initial pooled OLS estimates differ across the earnings distribution through using quantile regression techniques. Table 2 below presents only selected coefficients of interest within the model due to space constraint.

#### Remuneration determinants

Dependent Variable: Log monthly remuneration		
	Rural-urban migrants	Urban-urban migrants

.25 quartile		
Migrant status	0.0922*** (0.0347)	0.0915*** (0.0263)
Informality	-0.1390*** (0.0347)	-0.1306*** (0.0369)
Informality * migrant status	0.0320 (0.0497)	0.0367 (0.0551)
.25 Pseduo R2	0.1619	0.1652
.50 quartile		
Migrant status	0.0751*** (0.0255)	0.0795** (0.0339)
Informality	-0.0832** (0.0360)	-0.0939*** (0.0298)
Informality * migrant status	0.0214 (0.0487)	0.0064 (0.0402)
.50 Pseduo R2	0.1511	0.1543
.75 quartile		
Migrant status	0.0035 (0.0320)	0.0430 (0.0275)
Informality	-0.1109*** (0.0350)	-0.1042** (0.0422)
Informality * migrant status	0.0621 (0.0501)	0.0584 (0.0513)
.75 Pseduo R2	0.1884	0.1944
Interquartile regression		
Migrant status	-0.0888** (0.0347)	-0.0485 (0.0525)
Informality	0.0280 (0.0515)	0.0264 (0.0475)
Informality * migrant status	0.0301 (0.0678)	0.0217 (0.0917)
No. of observations	2786	2295

Source: RUMil data, year 2008 & 2009  
Notes: \*, \*\*, \*\*\* denote significance at the 10%, 5%, 1% confidence levels respectively. ( ) bootstrapped standard errors reported. For brevity, only selected variable estimates are reported although I include controls for age, age square, job tenure, log hours worked, and dummy variables for gender, marital status, city, industry, and year (year 2008=0).

The QR estimates complement the pooled OLS estimations as it allows examination of patterns beyond the mean. Interquartile regression (IQR) estimates in the bottom panel of table 2 are used to understand whether the effect of a particular independent variable on the dependent variable differs significantly between the 25th quantile and 75th quantile.

Quantile regression estimates provided in table 2, show that both rural-urban and urban-urban migrants attract an earnings premium. However, the earnings premium for both rural-urban migrants and urban-urban migrants exist in the low and mid quantiles. In fact, the significant negative IQR estimates (see bottom panel of Table 2) for rural-urban migrants confirms that rural-urban migrants attract an earnings premium only in the lower quantiles. Informality shows a penalising effect along the entire distribution of log monthly earnings in both models using rural-urban and

urban-urban migrant dummy variables. This trend is confirmed by the insignificant IQR estimates for rural-urban and urban-urban migrants, which again shows that the penalising effect of informality is observed throughout the earnings distribution. As for the interaction effects between migrant status and informal sector employment, there is no significant difference across quantiles for both models.

In unreported results, males earn more than females, although the magnitude of the effect is larger in the lower quantiles (confirmed by the significant negative IQR estimates). Higher levels of education are important towards the upper quantiles of the earnings distribution (confirmed by the significant positive IQR estimates). Longer job tenure seems to be an important predictor throughout the earnings distribution. Higher earnings are generated by longer hours worked, although the returns to hours worked reduces towards the upper quantiles. This trend exists perhaps because the remuneration in higher paying jobs is tied to many other performance indicators. Moreover, workers in low paying jobs tend to benefit from overtime pay whereas those in higher paying jobs may be compensated as a part of their basic remuneration package [24].

Overall, rural-urban and urban-urban migrants seem to attract an earnings premium. This finding is consistent with existing evidence from Indonesia [3]. New evidence in this research shows that this earnings premium is mainly in the lower quantiles of the earnings distribution. Evidence of migrants outperforming non-migrants is reported in other large countries like India which exercise free flow migration policies. For instance, Vakulabharanam and Thakurata found that internal migrants in India earned higher incomes as compared to non-migrants mainly as they were better educated than non-migrants. Results from this research reveal that an earnings premium exists even after accounting for the level of education, which may be indicating that there are other unobservable factors driving the premium (i.e. motivation, determination and drive) [16].

Informality seems to penalise regardless of whether the individual was a migrant or not. These findings are in line with existing evidence from Indonesian policy reports which suggest that after accounting for individual qualifications and characteristics, those working in informal jobs earn about 31 % less than a person working in formal jobs [23]. However, this penalising effect reduces towards the upper quantiles. Evidence of variation in informality penalty across the earnings distribution may provide some credence to the argument that individuals in the upper tier informal jobs remain in these jobs voluntarily as earnings are likely to be better and such employment may also provide certain non-pecuniary gains such as greater freedom, greater returns for certain characteristics like entrepreneurial skills [25-28]. Possibly, they trade formal protections as they have alternative forms of security like social networks [25] or insurance through the employment status of spouse or parents [29]. On the other hand, those in the lower tier

segment of informal jobs remain in these jobs despite the lower earnings due to lack of options. This variation of the informality penalty across the earnings distribution indicates that policies should not be applied in a uniform manner.

In unreported results it seems that males earn more than females, consistent with other studies such as that of Meng [7] and Gagnon et al. [30]. Further, this analysis shows that this earnings premium for males is larger in the lower quantiles of the earnings distribution, perhaps signaling that other more important aspects such as human capital factors may play a significant role in the upper quantiles. In fact, human capital factors such as job tenure and the level of education appear to be important determinants of earnings particularly in the upper quantiles of the earnings distribution. Higher levels of education may receive greater returns at the upper quantiles because education is more valued and considered necessary to perform higher paying jobs, whereas higher levels of education go beyond the needs of most jobs in the low-paying segment. Further, higher returns to education at the upper end of the remuneration distribution are interpreted as differences in ability (i.e. individuals with higher education would have greater ability as well) which translate into pay differentials [31]. This brings out the endogenous nature of the education variable, calling for cautious interpretation of these quantile estimates.

## V. CONCLUSION

This study assists in gaining a clearer picture of labour market outcomes of internal migrants in Indonesia. Both rural-urban and urban-urban migrants tend to earn more than non-migrants which complements findings from existing studies [3]. However, in an extension of previous work, the findings suggest that these earnings premiums exist mainly in the lower end of the earnings distribution. Moreover, this research sheds light on the informality effects within urban Indonesia. It shows that informality effects differ across the remuneration distribution as well, where there is a larger informality penalty at the lower end of the remuneration distribution. These findings hint at the possible existence of a tiered informal sector as well as the need for labour market policies which consider these differences.

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<sup>1</sup> Endogeneity could occur in these models when an individual's unmeasured characteristics such as ability are related to both the education variable as well as the value of remuneration one earns.



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# Information Technology Based Approach for Management of Forest Fire Controlling in Sri Lanka

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**Abstract**— Forest fire is one of the hazardous disasters that damage human lives and properties all over the world. However, there are several drawbacks in the existing forest fire controlling procedure in Sri Lanka. This concept paper presents a proposed study to develop a framework for dynamic resource allocation during a forest fire situation to mitigate the identified drawbacks. After reviewing the existing ICT based approaches available for dynamic resource allocation during disasters and their applicability for Sri Lankan context, a web based forest fire controlling system will be proposed. The proposed study reveals that the government of Sri Lanka as well as the citizens get benefits by adopting such ICT based solution to handle forest fires.

**Keywords**— *Dynamic Resource Scheduling, Disaster Management, Forest Fire Management, Information and Communication Technology*

## I. INTRODUCTION

Forest fires can be considered as one of the hazardous disasters that cause the destruction over the human lives and properties all over the world [12]. Due to the severity of the damage done by the forest fires, many countries tend to research on possible damage minimizing and risk mitigating techniques over the forest fires. The occurrences of the forest fires seems to be rising during past few decades with the continuous increment of global warming. Thus, protecting the nature has become quite challengeable task. Sri Lanka also has failed to lay off from this misfortune and each year a number of forest fire incidents are reported in the country.

Currently, Sri Lanka's forests, cover 29.7% of the total land area [16]. Each and every year forest fires destroy a considerable amount of forestland in Sri Lanka [3]. The Department of Forest Conservation and the Disaster Management Centre (DMC) of Sri Lanka reports that 50 to 200 Forest Fires are reported annually in the country depending on the prevailing weather conditions. According to a report by the Department of Forest Conservation, in 2016 fires had damaged more than 2,300 hectares (5,683 acres) of forest cover. 469.9 hectares (1,161 acres) and 229 hectares (565 acres) of forest cover was affected in Badulla and in Monaragala districts respectively [16]. Most of these forest fires occur in the forest plantations. Table 1 shows, information about the damages caused by forest fires from 1990 to 2012 in Sri Lanka along with the respective financial damages. However, most of the forest fire incidents in Sri Lanka do not take the attention of the majority of the community as well as the government authorities because information about loss of human lives, financial cost, and environmental damage occurred is not reported efficiently. Ariyadasa argues that forest fires become a huge threat to the

economy of Sri Lanka even though they have not taken a strong attention of the corresponding authorities [3].

The proposed study explores the current situation of forest fire handling in Sri Lankan context with the intention of identifying the drawbacks of the existing procedure. It proposes a forest fire controlling system to minimize damage and risks associated with forest fires by means of the prevailing approaches available in the world and their applicability in the Sri Lankan context. Citizens' participation is highly important to identify an occurrence of a forest fire. However, the scope of this study is limited to a study of functions carried out by the respective government authorities in Sri Lanka to control forest fires. The situation that arises after identifying a forest fire is considered during this study.

## II. RELATED WORK

There are many ICT based applications available in the literature to address various phases of a disaster—for instance, Sahana Eden [2], MABAS system [8], and BEHAVE [5]. Table 2 shows such ICT based applications identified by analysing the literature. Some of these applications specifically focus on forest fires while other applications focus on disasters in general.

TABLE 1: TOTAL BURNT AREA DUE TO FOREST FIRES

TABLE 2: SUMMARY OF THE ICT BASED APPLICATIONS AVAILABLE FOR DISASTER MANAGEMENT SOURCE: FOREST

Year	Number Of Fires Reported	Estimated Damage (US\$)
1990	1356	9788
1991	460	15245
1992	640	6861
1993	430	8204
1994	470	18588
1995	920	19458
1996	670	21465
1997	1500	44958
1998	504	7480
1999	1030	42227
2000	89	9788
2008	266.3	-
2009	2652	-
2010	2113	-
2011	1076.5	-
2012	2231	-

SYSTEM/APPROACH	KEY POINTS
Sahana Eden [2], [11]	<ol style="list-style-type: none"> <li>1. An open source software platform developed as a disaster management application.</li> <li>2. Maintain a detail list of important resources.</li> </ol>
MABAS System [8]	<ol style="list-style-type: none"> <li>1. Act as a centralized commodity.</li> <li>2. Contains details of almost every resource centre in a given area together with their resource levels.</li> </ol>
BEHAVE [1], [5], [7]	<ol style="list-style-type: none"> <li>1. Consists of two subsystems namely FUEL and BURN.</li> <li>2. Predict the real time forest fire behaviour.</li> <li>3. More suitable to describe the forest fires which spread through surface fuels.</li> </ol>
Forest Fire Weather Index [14]	<ol style="list-style-type: none"> <li>1. Use four meteorological observations (temperature, relative humidity, rain and wind).</li> <li>2. Build six components (Fine Fuel Moisture Code, Duff Moisture Code, Drought Code, Initial Spread Index, Build-up Index, Fire Weather Index)</li> </ol>
Real Time Optimal Resource and Work Force Allocation in Natural Hazard Management [6], [15]	<ol style="list-style-type: none"> <li>1. Use ARAs (Automated Response Area) for quick deployment of required resources to demand points.</li> <li>2. Get help from insurance corporations regarding the valuation of entities in order to prioritize scheduling process.</li> </ol>
Multi-Objective Model for Emergency Resource Allocation [4]	<ol style="list-style-type: none"> <li>1. Considers cost effectiveness of resource scheduling process while considering about the optimization of it.</li> <li>2. Track and store resource locations as a pre-preparation to a disaster.</li> </ol>

## FIRE DEPARTMENT, SRI LANKA

The functionalities of the ICT based applications shown in Table 2 were analysed to identify the key features that have to be addressed to avoid the existing problems in the current forest fire controlling procedure in Sri Lanka. By this evaluation three key features were identified—namely, resource tracking, forest fire spread estimation, and resource scheduling functions. Among the ICT based applications shown in Table 2, Sahana Eden system and MABAS System provide resource tracking functionality, BEHAVE system and Forest Fire Weather Index system provide forest fire spread estimation functionality, and Real Time Optimal Resource and Work Force Allocation in Natural Hazard Management system and Multi-Objective Model for Emergency Resource Allocation system provide resource scheduling functionality. However, none of these systems are able to provide all the three key functionalities together.

Cortez and Morais argues that meteorological observations such as temperature, relative humidity, rain and wind is important indications to spread forest fires [7]. High-end technology solutions such as satellite images are considered as the newest approaches to control forest fires. However, insufficient technological advancements and inadequate supportiveness for the costs draw barriers for using these approaches in Sri Lanka.

## III. RESEARCH METHODOLOGY

Research methodology is considered as the portrait of the blue print of research process [9]. Design science research methodology [10] will be followed throughout this research study. The proposed study will be conducted according to the phases of the design science research methodology that are shown in Fig. 1.

- Problem identification and motivation

This phase will be the starting point of the research study. During this phase field visits and interviews will be conducted to gather the details about the existing procedures of forest fire controlling in Sri Lanka and to identify drawbacks of the existing procedures.

- Literature review

Literature review will be conducted to gather information about the available mechanisms worldwide that can be used to overcome the identified drawbacks.

- Data gathering and analysis

A statistical data gathering and analysis will be conducted as the next phase of the project. Objectives of this phase are (a) identifying the factors that affect to spread forest fires and (b) identifying the relationship between the weather factors and the forest fire spread area.

- Design and development

During this phase, the findings of the literature review phase and data gathering and analysis phase will be used to develop an ICT based forest fire controlling application to Sri Lanka. The feasibility of using the proposed application with the existing technology infrastructure of the country will be highly considered when developing this application.

- Evaluation and interpretation of the results

The evaluation of the proposed solution will be designed and carried out during the next phase of the research study. Finally, the results of the evaluation phase will be used to analyse the success of the developed application as well as the entire research study.

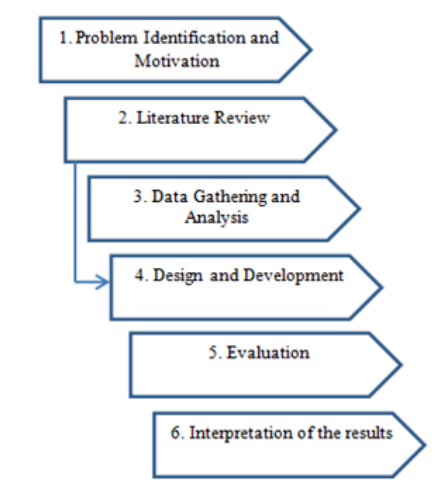


Fig.1: Phases of the Proposed Research Study

#### IV. DISCUSSION

As a developing country, Sri Lanka is struggling to manage its economy efficiently and effectively. Handling disasters in a proficient manner can be considered as one of the best ways to manage the economy in an efficient manner as it helps to mitigate the cost for rebuild after a disaster. Most of the developed countries try to merge information and communication technology with their disaster management procedures as it supports facing, controlling and overcoming disaster situations in a proficient manner. In Sri Lankan context there is a quite less attempts of using information and communication technology, especially in e-government approaches of emergency and disaster response management, to face the disaster situations. Lack of technology infrastructure and knowledge of information and communication technology draws barriers to integrate IT based systems to disaster response management. However, there is a huge necessity of exploring possible approaches of using information and communication technology in disaster situations in Sri Lanka.

This proposed study takes step to explore such possibilities based on the forest fire controlling procedure in Sri Lanka. Forest fire controlling procedure can be considered as one of the disasters that use least applications of information and communication technology. As the current forest fire controlling procedure in Sri Lanka highly depends on the involvement of humans, developing an information technology based system to assist the forest fire controlling procedure becomes a turning point in disaster management, especially forest fire controlling process, in Sri Lanka.

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# Sri Lankan Sign Language Tutor

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**Abstract**— Sign Language Recognition is a challenging research area of Human Computer Interaction. This system proposes a method which recognizes signs of Sri Lankan Sign Language using Fourier Transformation, which is invariant to translation, scaling, rotation and change of starting point. It discusses about using a Centroid distance based shape signature, which is capable of preserving both local and global information of the shape.

This concept would be highly beneficial for primary school students who try to learn the basics of sign language. This system will help them to practice & check their knowledge without any help of their teachers or parents.

Digital Image Processing Techniques were used to obtain a closed contour image from the input image. Feature Extraction is done by using the theories of Fourier Transformation. Artificial Neural Network has been employed to train a large set of signs in order to increase the efficiency of the system. Supervised training method was used to train the neural network, which consists of 10 input nodes, 6 hidden layer nodes and 8 output nodes. The calculated weights were stored in file.

The system is implemented using C# programming language and Aforge.NET framework.

A still image of the sign is taken as the input for the system. The weight file, which is generated at the end of training the system for nearly 800 images of signs, was used to recognize the sign. The system will output the correctness of the sign to the user using visual indicators.

The system is capable of recognizing 8 static signs of Sri Lankan Sign Language successfully.

**Keywords**— Sri Lankan Sign Language, Digital Image Processing, Fourier Transformation, Artificial Neural Network

## I. INTRODUCTION

Sign Language Recognition is one of the major research areas of Human Computer Interaction. A large number of researches had been done in this area for American Sign Language, Indian sign language[7], Chinese sign language, Thai sign language, etc. But, less amount of researches are done related to Sinhala sign language recognition[4],[5]. Specially no research work found in developing a tutor for Sinhala sign language. This reason motivated me to carry out this research to develop an automated tutor to the deaf community. The target group of this system is the primary students of Deaf School.

There are different sign languages in the world. In Sri Lanka, the deaf community use Sri Lankan Sign Language. There exist different sign languages for different deaf schools according to the regional areas. But the Sinhala Alphabet is almost the same.

There are problems when teaching sign language to disabled children such as, lack of teachers, less or no

attention to every child at every moment due to lack of resources, parents of these disabled children may be too busy, less interest of children to study, etc. As a solution this system will help to practice & check their knowledge without any help of their teachers or parents, as a computer is an infinitely patient teacher.

## II. METHODOLOGY

### A. System Overview

This system can be divided into four major phases as shown in Fig. 1.

In Image Acquisition phase, a collection of 8 static signs as shown in Fig. 2 were captured by A4Tech 1.3MP USB connectable Web Camera. These images were captured under certain limitations to increase the accuracy of the system. The images were taken in front of a black background. The user has to wear a long sleeved black top or a black band with a white glove. Each image includes a sign in Sri Lankan Sign alphabet. All the images were taken under resolution of 200\*200 dpi.

In Image preprocessing phase a number of image processing techniques such as Grayscale filter, Gaussian Blur filter, Iterative Thresholding filter, Morphological filters, Canny Filter, etc. were used to take the contour of the sign which will be the input of the next phase as shown in Fig. 3.

In the Feature Extraction phase, Centroid distance based Fourier Descriptors were used to extract features from the contour of each sign [1]. Contour of the shape of each sign was sampled into 64 points and centroid based shape signature was calculated using (1). (Fig. 4)

$$r(t) = ([x(t) - x_c]^2 + [y(t) - y_c]^2)^{1/2} \quad (1)$$

where,

$$x_c = 1/L \sum_{t=0}^{L-1} x(t)$$
$$y_c = 1/L \sum_{t=0}^{L-1} y(t)$$

The resulted shape signature is transformed into its frequency domain by applying Discrete Fourier Transformation. The generated Fourier coefficients were indexed to achieve shape invariance. First ten Fourier coefficients except the first coefficient were used to feed the neural network's input nodes.

In the Recognition phase An Artificial Neural Network was designed with 10 input nodes, 6 hidden nodes and 8 output nodes.

Based on the training of the neural network for the signs, it will generate a file with calculated weights. This neuron weight file will be used to get the output for a sign in real time. It delivers the correctness of the sign (right/wrong) to the user.

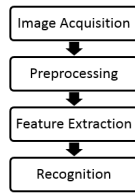


Fig. 1. System Overview

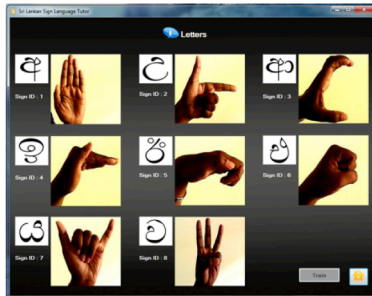


Fig. 2. : Recognized signs of Sinhala Alphabet

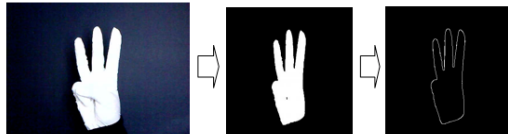


Fig. 3. : Conversion of the RGB image into a contour image

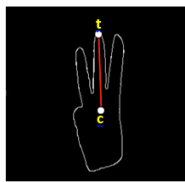


Fig. 4. : Centroid distance

### III. IMPLEMENTATION

As the target group of this system is the primary students of Deaf School, graphical user interface of the system was designed in a simple manner and more colors were used.

Start-up window provides four options as shown in Fig. 5. They are Learn, Search, Help and Letters & Training.

Learn window is the main window of this system as shown in Fig. 6. It will facilitate the user with image acquisition and checking the correctness of it with few button clicks. First the user has to select and click on a letter. Then he/she can pose the sign, capture the image and check the correctness of the sign. A visual indicator will show the correctness of the sign as shown in Fig. 7.

Search window will facilitate the user to search a sign. It will produce an image of the letter of the corresponding sign. User can pose the sign and search the letter of the corresponding sign. Help window will provide the instructions to follow when using the system. Letters window displays the list of letters with an image of each sign. It will also show the ID of each sign, which is useful in training more samples for each sign in Train window.

Train window is used to train the system with more samples to minimum error rate. Admin can select the sign ID, capture an image of the corresponding sign, process the image, get the Fourier descriptors and add those descriptors and corresponding output pattern to the input and output text files of the Neural Network. This window provides the facility to train a Neural Network from the beginning, stop the training and resume the training from the previous state.



Fig. 5. Start-up window

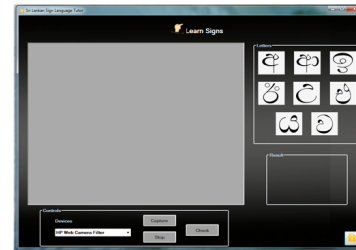


Fig. 6. : Learn window



Fig. 7. : Visual Indicators for the correctness of sign

### IV. TESTING AND RESULTS

The system is tested with 800 images of signs including 100 images from each sign for scale, rotation, translation and starting point invariance and the obtained accuracy level for each letter is listed in Table 2.

The system is trained by using 200 images of signs including 25 images from each sign.

ACCURACY LEVEL FOR LETTERS

Letter	Accuracy
අ	100%
ඊ	100%
ඉ	80%
උ	80%
ඌ	70%
ඍ	70%
ඎ	70%
ඏ	60%

## V. CONCLUSION

Sri Lankan Sign Language Tutor is capable of recognizing 8 static signs, which are invariant to scale, translation, rotation and starting point. Different lighting conditions and image noise may fail the sign recognition. But under the constraints, system is able to deliver accurate results successfully.

The system uses Centroid based Fourier descriptors for feature extraction. Although the centroid distance is taken based on the boundary information it contains the region information as well. Centroid distance preserves both local and global information of the shape. Fourier Descriptors are easy to derive and are robust to image noise. And also Fourier descriptors provide easy shape normalization, which is mandatory in shape comparison. By using normalized Fourier coefficients, we can obtain translation invariance, rotation invariance, scale invariance and starting point invariance.

## VI. FUTURE WORK

The system can be extended to recognize more number of Signs in Sri Lankan Sign Language including dynamic signs. It can be used to validate words and sentences in Sri Lankan Sign Language by using a video.

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# The Relationship between Personality and Perceived Career Choice of the University Students in Sri Lanka

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**Abstract—** Choosing the career which most suits one's personality is considered to be a significant factor for future success in the workplace. As there are certain careers that suit specific personalities, attention should be given when choosing a program of study which ultimately leads to a career. The main objective of this study is to examine whether there is a relationship between personality and perceived career choice among Sri Lankan university students.

This study was conducted using data obtained from 150 undergraduates of five different faculties (Management, Engineering, Law, Medical and Arts) and from three different universities in the Western Province in Sri Lanka. Data was gathered using a mixed method of questionnaire survey and interviews. The Five Factor Model (Big Five) was used to measure the personality of the students and perceived career choice was based on their degree program. The results of the study revealed that there was no relationship between personality and career choice of the Sri Lankan university students. The qualitative analysis showed that there are other factors which influenced the career choice irrespective of personality, such as parental pressure and perceived societal status. These results implied that students who followed certain degree programs may not necessarily like what they are doing as well as they may not be very successful in their perceived future career. As such, it is recommended that student personality be factored into the career choice process for Sri Lankan students at an appropriate stage of their educational pathway.

**Keywords—** *personality, big five model, career choice, undergraduates, Sri Lanka*

## I. INTRODUCTION

Individuals differ from one another due to various factors such as personality, abilities, intelligence, background, attitudes, perceptions, motivation, culture, roles they play, gender, race, disability [1]. These factors are the main contributors to our behavior or simply they make us individuals. In world literature we can find out many research work performed by many psychologists, counselors and academics to find out how individual differences effect peoples behaviors in different situations across their life span (E.g. education, vocation, family life, etc.).

Among major factors affecting individual differences, personality is a significant and decisive factor that's makes oneself an individual. Almost all of us have differing personality traits which in turn decide our behavior. Although our behavior also influenced by situational variables, our cognitive and thought processes (i.e.

personality) also has a significant impact on deciding our behaviors in different situations [2]. Thus, personality has also become a major interest area of research. Many empirical studies have performed to found personality traits and their influence on peoples' behaviors such as education, vocation, family life, social life.

Vocational behavior involves how people behave in their work life. This includes many sub elements such as career processes, career related processes, occupational satisfaction and wellbeing and organizational outcomes [3]. Vocational psychology involves in studying these vocational behaviors of the people, thus many literature can be found out in this area specially relating to individual differences and its effect on vocational behaviors.

Career Choice is a first and most important decision that any individual take in his or her lifetime. Thus, it is a major vocational behavior that should be considered. There are many studies done in international level to find out relationship between one's career and his or her personality. Many of these studies have revealed that it is very important to choose a congruent career with the personality as it can predict future career success. However, it was evident after an extensive search of literature, that this subject matter has not given proper attention in Sri Lankan scenario. Although there some studies done in areas such as career choice [4], personality and job satisfaction [5]; there were no or less empirical evidence available in Sri Lanka which were specifically addressed the relationship between personality and career choice. Thus, it is very important research this topic in Sri Lanka. Outcomes of such research will aid people to find a suitable career for their personality while aiding to develop career development and career planning activities of the corporate sector.

## II. BACKGROUND

There is no universally agreed definition for the concept "Personality". Different academics have defined personality in different ways. Luthens (p. 126) state "... personality will mean how people affect others and how they understand and view themselves, as well as their pattern of inner and outer measurable traits and the person-situation interaction" [6]. According Lau & Shaffer, p.225) "Researchers generally agree that personality is [defined as] the dynamic and organized set of characteristics of a person that uniquely



influences his or her cognitions, motivations and behaviors” [7]. McKenna stated “there is a general agreement between most of theorists that personality is a complex phenomenon which consist wide range of physical, mental, ethical, and social qualities specific for each individual.” [1]. Thus, the concept of personality has different perspectives.

In personality literature, academics discuss about models and approaches for personality such as [1];

- Extroversion-Introversion typology
- Myers Briggs Type Indicator
- Type A and B personalities.
- Eysenck’s approach
- Five factor model/ Big 5 model
- RIASEC typology

Among these personality models, many empirical studies which relate to career and personality has used Big Five model; Five Factor Model is a widely accepted framework because of its stability, reliability, validity, and universality [8]. Based on comparisons of information gathered by NEO inventories of different countries, Five Factor Model has shown consistency across different cultures [9]. In a longitudinal study carried out using NEO PI, McCrea and Costa found that the factors show stability [1, 9]. Also, the validity of broad dimensions are higher than too narrowly defined dimensions [9]. Tokar, Fischer, & Subich referring McCrea & Costa (1989, 1988) state that Five Factor model holds claim to comprehensiveness which is proved through meaningful convergence between other major personality structures such as Murray’s (1938) Taxonomy, Jung’s (1923) psychological types, Eysenck’s (1947) two factor model, Leary’s (1957) interpersonal circumplex and Big Five measures [3].

Five personality dimensions can be broadly described as follows.

**Neuroticism:** This dimension indicates tendency to experience negative effects such as fear, sadness, embarrassment, anger, guilt, anxiety, angry hostility, depression, self-consciousness, impulsiveness and vulnerability. A person who scores high on this dimension will also show maladjustment, less able to control impulses. But this is indeed a measure of general personality, not an indicator of psychopathology. High scorers may be at risk for psychiatric problems [2, 9, 10].

**Extraversion:** Extraversion consists traits such as warmth, sociable, assertive, excitement seeking, optimistic, energetic, and positive emotions. Extraverts also like large groups and gatherings and they are cheerful in their disposition. Often, we call opposites of the extraverts as introverts. But it is not the direct opposite of the extraversion traits; rather it can be seen as absence of extraversion. Introverts are reserved, independent, but they are not unfriendly, unhappy or pessimistic [2, 9, 10].

**Openness to experience:** This dimension includes fantasy, aesthetic sensitivity, and attentiveness to inner feelings, ideas, values, intellectual curiosity, and independence of judgment. A person who has a high score in openness dimension is very curious about his or her inner and outer world. They are willing to accept novel, unconventional ideas and values which promote new ethical, social and political tendencies. But that does not mean that they are unprincipled, thus they have an evolving value system. In contrast closed person may choose conventional behaviour and conservative philosophy. But they are not intolerant authoritarians [2, 9, 10].

**Agreeableness:** A person, who reports high level of agreeableness shows following traits trust, sympathy towards others, altruistic, compliance, modesty, and tender mindedness. Agreeable people are very cooperative and eager to help others and they also believe others will do the same for them. A low agreeable person can be identified through antagonism, egocentrism, competition, and skeptical to others intentions [2, 9, 10].

**Conscientiousness:** This includes competence, order, dutifulness, self-control, achievement striving, responsibility, and deliberation. Conscientious individuals often show strong will power and they always strive for achievements. Thus, high conscientious person is associated with academic and occupational achievements. But it also may have a negative side such as annoying fastidiousness, compulsive neatness or workaholic behaviours. High scorers of this dimension are scruples, punctual, and reliable. That does not mean low conscientious personality lacks in these traits but, yet they are less exact in applying them [2, 9, 10].

There is vast amount of literature that explains relationship between variety of vocational behaviors such as occupational stress, burnout, undesirable organizational outcomes, career progression, career change, mentoring [3]. This shows that personality indeed an important factor in vocational behavior and choosing a career that is congruent with personality type is very important for successful career life. Career choice is also a subject that is widely researched in the vocational psychology. Many researchers have studies the relationship between personality and career choice of students and professionals such as; Nienke & Stomer using German sample [11]; Ham, Junankar, & Wells [12, 13] using Australian sample; Rubinstein & Strul [14] and Rubinstein [15] using an Israeli sample; Kline & Lapham using a UK university sample [16]; Jarlstrom (2000) using a sample of Finish business students [17]. Here first five studies were based on Big Five model and latter was based on Myers Briggs Type Indicator.

Niken & Stomer classified occupations in to six groups; manual workers, managers, technicians, Clerks, Service workers and professionals and studied their relationship with Big five personality dimensions of large representative male sample [11]. They found that, manual workers report high neuroticism level than other

occupational groups while managers reported lower level of neuroticism (i.e. emotional stability). Niken & Stomer also found that extraversion had significant relationship with managers and service workers who tend to have high social interaction while professionals and manual workers showed lower level of extraversion. Regarding openness technicians and professionals who work in changing work environments showed higher levels of openness while clerks and manual workers reported lowest. Evidence didn't support their hypothesis regarding conscientiousness, thus manual workers reported highest levels of conscientiousness. Even though they expected high level of agreeableness in social jobs such as service workers, professionals and technicians reported higher levels of agreeableness [11].

Ham, Junankar, & Wells in their study to find relationship between Five Factor Model (i.e. Big five) and white collar and blue-collar occupations stated that except for extraversion all other personality dimensions of the Five Factor Model have a significant impact on occupational outcome (i.e. being in a white collar or blue collar job) [13]. Further in the same study authors stated that higher conscientiousness can lead a person to being in a white-collar occupation regardless of their gender. And for males high openness and emotional stability (i.e. lower neuroticism) has an association with white collar jobs. They also found that agreeableness does not have a significant effect on a person to being in a white collar job. However, referring to Heckman, Stixrud & Urzua (2006), Ham, Junankar, & Wells stated that non-cognitive factors also have an effect on these findings especially for women [13].

Ham, Junankar, & Wells in representative Australian sample found that openness to experience have an effect on person being in a managerial or professional role rather than an operator or a labourer. Higher conscientiousness level had associations with managerial and clerical jobs while lower level scores tend to be in sales, operator or labour positions. They also found extraversion may lead a person to being in a management or sales job, while lower extroverted person may choose a clerical or labour occupation. Social occupations, operators and clerks showed high level of agreeableness while managers and technicians showed least levels. Finally, higher emotional stability (i.e. lower neuroticism) scorer tended to be in professional job, while lower scorer may tend to work as a clerical worker [12].

Rubinstein & Strul researched personality of four male and female Israeli professionals using Five Factor Model of personality found that Artists are more neurotic than other professionals researched. (i.e. Clinical psychologists, Lawyers, Doctors.). Lawyers scored highest level of extraversion while Artists were more open than others. Clinical Psychologists tended to score high in agreeableness comparatively. Finally, regarding conscientiousness Artists scored significantly low level than others [14].

Rubinstein performed a study to explain big 5 personality of Israeli university students who belong to Law, Social Sciences, Natural Sciences, Arts Faculties. In this study Rubinstein revealed that law students are more neurotic and less open and agreeable compare to students of other faculties. Further, stated that there are no significant differences in conscientiousness level comparatively in all faculties while natural science courses are chosen by students who tend to show less extraversion traits [15].

Kline & Lapham in their research study they did using sample of 1472 UK university students, found that Science and Engineering students report high level of conscientiousness than other students. They also revealed that Science and engineering students report high level of conformity (i.e less openness to experience) compare to students of Arts and Social students[16]. Engineers also show tough minded personality (i.e. lower agreeableness) compare to other students. In this study Kline & Lapham also state that science faculty students' show high level of neuroticism, which is different to results shown in then Rubinstein study of Israeli university students [15]. Further in this study science students showed lowest level of extraversion compare to others.

Jarlstrom in her study based on Myers Briggs Type Indicator and career anchor theory with Finnish business students career expectations found that Introverts had expectations in Technical competence, Independence, Creativity while extroverts expected Managerial, Service, and Pure challenge. Sensing types associated with Technical and Managerial competence and Security. Intuitive types related with Independence, Pure challenge and Creativity. Thinking type had expectations on technical competence while feeling type to Independence and Service. Judging types related to Technical competence, Management competence, and Security [17].

Although there is very less empirical evidence, directly relating to influence of personality in career choice found in Sri Lanka. Gallhena & Rathnayake in their study to find factors affecting career choice of Sri Lankan management undergraduates, found that personality attributes as the second-best factor that undergraduates have considered when selecting a career. In gender level; male students have ranked personality average as third best factor while female students have ranked second best factor. This is in fact a very interesting finding which invites to research much about how personality affects career choice of the Sri Lankan university students. Especially in identification of different personality profiles in different career paths will be very vital [4].

Based on above empirical evidence following testable hypothesis were developed to test whether the relationships theorized hold true.

**H0: There is no relationship between personality and career choice of Sri Lankan university students**

**H1: Management students are more extraverted than other students**

Above expectation is based on evidence shown in Niken & Stormer; Ham, Junankar, & Wells which reported high level of extraversion in people who are in managerial occupations which have high level of social interactions [11, 12].

**H2: Engineering students are more conscientious than other students**

Tokar, Fischer, & Subich based on research study done by Silver and Malone (1993) and also Kline & Lampham suggests that engineers tend report high level of conscientiousness [3, 16].

**H3: Arts students report more neuroticism level than other students**

Based on evidence revealed in the studies carried out by Rubinstein & Strul and the comments made by Tokar, Fischer, & Subich based on research study done by Silver and Malone (1993); we expect that arts faculty students will be more neuroticism oriented than other students [3, 14].

**H4: Medical Students report more agreeable than other students**

Results reflected in the study carried out by Rubinstein & Strul medical professions (i.e doctors and clinical psychologists) shows high level of agreeableness compare to other professions they researched [14].

**H5: Law Students report lower level of openness than other students**

In the studies carried out by Rubinstein & Strul (2007) and Rubinstein (2005) lawyers and law students have reported lower level of openness compare to other professions researched. So, it is expected that law students will report lower level of openness compare to other students [14, 15].

### III. METHODS

#### A. Sample

This research study analyze data based on different students' groups who follow different degree programmes such as engineering, arts, management, law, medicine. Thus, the personality patterns of different groups are analyzed in order to find out its relationship with their career choice (explained by their choice of university major). Hence the population of this study is Sri Lankan University Students. According to university grants commission (2010) there is 94864 students in 15 Sri Lankan state universities.

Two-staged stratified random sampling process was adopted to select the sample. In the first stage stratum was selected non-randomly and then elements within each stratum was chosen randomly. For this study; students from Management, Engineering, Arts, Medical, and Law faculties of different universities was used, as they are regarded as student's first choice in respective career field. 30 students from each of above mentioned faculties were used in this study. Total amount of students in the sample was 150.

#### B. Data Collection

In this research study, primary data was gathered through two main sources, those are questionnaires and interviews. Data about personality attributes of the students were collected through questionnaires which represent the quantitative part of this study. Data which relate to qualitative aspect were gathered through face to face interviews and through a sub part in the questionnaire.

The questionnaire includes 4 sub parts or sections. First two part of the questionnaire was used to gather data about demographic information of the students such as gender and faculty of study. Third part of the questionnaire consists data about personality attributes of the students based on Five Factor Model (i.e. Big Five) of personality. For this purpose, a scale of 60 items will be developed referring to other scholarly work which used Five Factor Model of personality to measure personality of a person such as Ham, Junankar, & Wells (2009a, 2009b); McCrae & Costa (2010). Since the native language of the respondents is Sinhalese, items were presented in Sinhala language, as it enhances the understandability of the items. Respondents was asked to record their agreement with the items through 5-point Likert scale, with being 5 "Strongly agree" and 1 being "Strongly Disagree" (Sekaran & Bougie, 2010; McCrae & Costa, 2010). Each dimension of the Five Factor Model (FFM); Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C) will be represented by 12 items in the developed scale. All the facets explained in the conceptualization, which represent each dimension or factor in the Five Factor Model of personality; was covered through these 12 items. Final Part of the questionnaire asks respondent to explain any other factors that influenced his/ her career choice (i.e. selection of degree). This was helpful in the qualitative aspect of this study. That is to find whether there are any significant moderating or mediating variables that influence career choice of a person other than personality.

Content Validity of the instrument is optimum as it is based on consensual conceptual framework about personality (i.e. Five Factor Model of Personality) which was used in many international empirical studies with regard to personality, occupational psychology and specifically for career choice [3, 10, 14]. Further operationalization of the Conceptual framework also based on several validated international instruments such as NEO PI [10] and Ham, Junankar, & Wells [12, 13]. Accordingly, Personality is

measured by 5 dimensions (i.e Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness) and each dimension is further divided into 6 facet scales or elements to ensure the validity of the measure. Ultimately there are 12 items which tap each personality dimension. Thus, the content validity of the instrument is high.

Face validity of the questionnaire is also ensured by giving draft questionnaire to small sample of university students and lecturers. Questionnaire was amended according to the comments given by the sample; in order to enhance the clarity and understandability of the statements.

Reliability of the 60 item personality measurement was tested using Cronbach's alpha reliability test. All the personality dimensions reported Cronbach's alpha ( $\alpha$ ) value more the 0.7.

In order to gather data for the qualitative part of this study, interviews were organized with students from each of the faculties where data was gathered for the quantitative study. Interviews were based on semi structured type. All the interviewees were asked a pre-determined set of questions and then if needed more questions was asked based on the answers given for structured questions. This was helpful to find whether there are any other factors affecting the relationship between personality and career choice. 5 students were selected from the sample representing each faculty as the participants of the interviews.

#### IV. RESULTS

##### A. Personality Profiles of students

Management students have reported more Neuroticism (N) level ( $M= 3.04$ ) than other students, Arts students have become close second in Neuroticism levels ( $M= 3.02$ ) with lesser standard deviation ( $SD= .44$ ) compare to their management counter parts ( $SD= .47$ ) who scored top in Neuroticism. Law students have reported lowest amount of Neuroticism level ( $M=2.74$ ) while engineering and medical students have similar level of Neuroticism ( $M= 2.88$ ) although medical students have a higher standard deviation ( $SD=.65$ ) compare to engineering students ( $SD=.47$ ).

Management student has also scored highest in Extraversion personality factor ( $M= 3.52$ ) compare to other students with highest standard deviation ( $SD= .55$ ). Law faculty students are the least extraverted ( $M= 3.39$ ) compare to other students. Arts faculty students are also showing almost similar level of extraversion ( $M=3.40$ ,  $SD= .47$ ). Medical and engineering students have gained 2nd and 3rd place in the extraversion personality dimension.

In the Openness personality dimension again, management students have scored more ( $M= 3.44$ ,  $SD= .42$ ) than their other counterparts. Lowest scorers in the Openness dimension are law students ( $M= 3.28$ ,  $SD= .51$ ).

But they have reported higher standard deviation compare to other students' groups. Arts, medical, engineering students have ranked 2nd, 3rd and 4th places in Openness dimension.

Law faculty students are the most agreeable students compare ( $M= 3.69$ ,  $SD= .52$ ) to other faculties, although their standard deviation is highest compare to other faculties. Medical students are the lowest scorers ( $M=3.30$ ,  $SD= .50$ ) in the agreeableness dimension. Arts, management and engineering students have ranked 2nd, 3rd, 4th places in the agreeableness facets. In the Conscientiousness personality dimension Law students again ranked first being the highest scorers ( $M= 3.77$ ,  $SD= .60$ ). However, their standard deviation also higher compare to other students. Engineering students were the lowest scorers ( $M= 3.48$ ,  $SD= .48$ ) in conscientiousness dimension compare to other students. Management and arts students reported similar level of conscientiousness.

##### FACULTY WISE PERSONALITY PROFILE

Personality Factor		N	E	O	A	C
Engineering	Mean	2.88	3.42	3.31	3.36	3.48
	SD	.43	.51	.43	.37	.48
Management	Mean	3.04	3.52	3.44	3.46	3.63
	SD	.47	.55	.42	.42	.40
Arts	Mean	3.02	3.40	3.40	3.61	3.63
	SD	.44	.47	.41	.46	.45
Law	Mean	2.74	3.39	3.28	3.69	3.77
	SD	.42	.46	.51	.52	.60
Medical	Mean	2.88	3.46	3.39	3.30	3.57
	SD	.65	.44	.38	.50	.59

##### B. Differences in Career choice

In order to find out whether there are significant differences among faculties for each personality dimension. Independent Sample T tests were performed based on the hypothesis developed. T tests were performed comparing each faculty with the base faculty stated in the hypothesis.

- a) H1: Management students are more extraverted than other students

According to above table none of the faculties reported significant differences with management students (Base Faculty) for extraversion personality dimension at 0.05 significant level. Aggregated sample of engineering, arts, law medical also didn't report a significant difference with management students for Extraversion.

- b) H2: Engineering students are more conscientious than other students

According to t test results, management, arts, medical students did not report any significant differences with engineering students (Base faculty) at 0.05 significant level. However, at 0.05 significant level, law students reported significantly higher level ( $M=3.77$ ) of conscientiousness than engineering students ( $M=3.48$ ) ( $t(58) = -2.069$ ,  $p = 0.043$ ). This was an opposing result for the hypothesized relationship where engineering students should report more

conscientiousness level than other students. The aggregated sample consisting management, arts, law, medical students also did not report any significant difference with the engineering students on conscientiousness personality dimension.

- c) H3: Arts students report more neuroticism level than other students

Based on above information Engineering, Management, Medical students did not show any statistically significant differences with arts students for Neuroticism scale at 0.05 significant level. But there was a statistically significant difference between law and arts students for Neuroticism at 0.05 significant level. Hence law students reported significantly low level ( $M=2.74$ ) of Neuroticism compare to arts students ( $M=3.02$ ) ( $t(58)=2.530$ ,  $p=0.014$ ). This finding supports the hypothesized relationship. However, the aggregated sample consisting engineering, management, law and medical students did not show any statistically significant difference in Neuroticism personality dimension at 0.05 significant level.

- d) H4: Medical Students report more agreeableness than other students

Findings revealed that medical students did not show any statistically significant difference with engineering and management students at 0.05 significant level for Agreeableness personality factor. However, at 0.05 significant level, Arts ( $M=3.61$ ) ( $t(58)=-2.511$ ,  $p=0.015$ ) and Law ( $M=3.69$ ) ( $t(58)=-3.0071$ ,  $p=0.004$ ) students reported significantly higher level of agreeableness level compare to medical students ( $M=3.30$ ). Aggregated sample also showed significantly higher level of agreeableness ( $M=3.53$ ) compare to medical students ( $M=3.30$ ) ( $t(148)=-2.460$ ,  $p=0.015$ ). These do not support hypothesized relationship; hence it shows a relationship opposite to hypothesis.

- e) H5: Law Students report lower level of openness than other students

According to findings there were no statistically significant differences between Law students and other students on individual basis or aggregated basis at 0.05 significant levels.

## V. DISCUSSION

### A. Management students are more extraverted than other students

In the mean comparison stage, management students indeed reported higher mean value ( $M=3.52$ ,  $SD=.55$ ) than other students who were researched. However, in the independent sample t-test procedure, it is revealed that there is no statistically significant difference among mean level of management students and other students either in individual level or at aggregated sample of non management students. This result did not support the hypothesis which was based on international studies of Niken & Stormer [1]; Ham, Junankar, & Wells [2].

This contradictory result can be explained through qualitative analysis. In Case A, a person who wants to select arts field has selected management due to his parents' pressure. Further, in the questionnaires some have stated that following arts degree will not help them to get a good job in the future. So ultimately there are other factors that influenced career choice of the student than their own personal choice. This can be also explained by the research of Galhena & Rathnayaka; they stated that management undergraduates consider personality as second best factor when selecting their career [3].

### B. Engineering students are more Conscientious than other students

Although international research evidence such as Tokar, Fischer, & Subich based on research study done by Silver and Malone (1993) and also Kline & Lampham suggests that engineers tend report high level of Conscientiousness [4, 5]. In Sri Lankan context surprisingly engineering students scored the lowest among of Conscientiousness level ( $M=3.48$ ,  $SD=.48$ ) compare to other students. Highest scorers in Conscientiousness personality factor was law students ( $M=3.77$ ,  $SD=.60$ ). Thus at the mean comparison stage the hypothesis is rejected. Engineering students do not report higher Conscientiousness level compare to other students.

However Independent sample t-test were carried out to find out whether there are significant differences among Conscientiousness levels between engineering and other students. The results of the independent sample t test revealed that law students have significantly higher level of Conscientiousness than engineering students. Irony here is that it says that law students should be engineers. The students of other faculties did not show any statistically significant differences in their Conscientiousness scores with engineering students either on individual basis or aggregate non engineering sample. This result also gives insights that personality is not the only source that Sri Lankan students consider when selecting their career field. In case E, factors other than personality such as social status and benefits of the engineering career, family influence has modified the career choice of the respondent.

### C. Arts students report more neuroticism level than other students

In Sri Lankan context, most neurotic students group are the management students ( $M=3.04$ ,  $SD=.47$ ). However, arts students reported mean level ( $M=3.02$ ,  $SD=.44$ ) for Neuroticism which is very closer to their management counterparts with a lower standard deviation. Again, at the mean comparison stage the hypothesized relationship is rejected as current study do not support international research evidence of Rubinstein & Strul and the comments made by Tokar, Fischer, & Subich based on research study done by Silver and Malone (1993) [4, 6].

Independent sample t-test also did not reveal any statistically significant differences among arts and other students, except for law students. Law students reported significantly lower level of Neuroticism compare to arts students.

In interviews it was revealed, a person who has high neurotic oriented personality and he is very talented on artistic work. But due to parental pressure, as arts graduates do not have better job opportunities and social status. He selected management field. Now he finds management is not the best field for him. This may be the case that arts and management students report almost similar level of Neuroticism level. Many students who want to select arts field, moves to management as arts degrees do not have good social recognition. Further these students are not good at science subjects. So, they naturally moves management field. However, in interview evidence, there is a success story where the person selected her career 100% freely and now she is self-fulfilled (i.e. her personality profile showed high neuroticism level).

*D. Medical Students report more agreeableness than other students*

On the independent sample t-test, it was found that arts students and law students have significantly higher level of agreeableness level compare to medical students. However, there was no statistically significant differences among engineering and management students compare to medical students. Aggregated non medical sample also showed significantly higher level of Agreeableness level compare to medical students. Hence the hypothesized relationship is clearly rejected.

In Sri lankan context entering into a medical faculty is a very competitive task as there are very fewer number opportunities. Due to this highly competitive nature; students also may have developed their behavior to be less agreeableness which means tough minded, lack of altruism and self-centered behaviors. On the other hand, one interviewee explained that parents have influenced him to choose medicine field due high social status and recognition. Cases like this may be also having an impact on this contradictory result.

*E. Law Students report lower level of openness than other students*

In the mean comparison law student reported lowest score for Openness factor ( $M=3.28$ ,  $SD= 0.51$ ). Management students who scored 3.44 mean levels with a standard deviation of 0.42 were the highest scorers in Openness factor. However, in the independent sample t-test, there were no significant differences reported among Law students and other students either individually or aggregated non-law student sample. In the studies carried out by Rubinstein & Strul and Rubinstein lawyers and law students have reported lower level of openness compare to other professions researched [6, 7]. This finding was only partially

valid in Sri Lankan context as there is no statistically significant difference on openness levels among the different students compare to law students.

In the Sri Lankan university culture, students often tend to be open-minded, due to academic and peer socialization. This environment may lead them to score similar level of Openness without any significant differences. However, this may be different when they practice as professionals.

## VI. IMPLICATIONS OF THE STUDY

There are several key learning points that should be considered with the outcomes of this research study. Although there is sound international evidence about personality and career choice of students as well as professionals; application of these results in Sri Lankan context is problematic. None of the hypothesized relationships were supported by the current study.

It seems that Sri Lankan university students' career choice is influenced by many other factors other than their personality, such as parental influence, advises given by teachers, friends and seniors, financial rewards relating to the career, social recognition for the career, job market opportunities. Although the exact significant level of these factors are not yet researched for overall university sector, in the research study performed by Galhena & Rathnayaka based on management students sample explains there are lot of other influencing factors [3]. However, in the same research study personality has ranked as second best factor when selecting a management career.

In the qualitative analysis, there were some critical points that should be considered. In summary majority of the case studies explain that if a person selects an incongruent career for his or her personality. There may be problems in the latter stages of the career. For example, some interviewees now suffering from wrong selection he made due to parental pressure. On the other hand, some interviewees explained their free choice helped them to be satisfied with their career. This also gives good insight on career satisfaction due to personality and career congruence. Further, case study analysis repetitively emphasize that arts field is perceived as a useless career field in Sri Lankan context and that has caused many students who can excel in that field select other careers.

Finally based on this data we cannot identify a clearly distinctive personality attributes for each of the students' groups and their careers. Thus, relationship between personality and career choice is very low. Cultural influences on these results must also consider, as sometimes hypothesized relationships are based on the studies carried out in western cultures which are significantly differ from Sri Lankan culture. However, this area is open for further research.

## VII. CONCLUSION

Career life is one of the most important parts of a person's life. Thus, selecting a congruent career in the early stage of the life helps individuals effectively develop their career. This not only helps the individual success of that person, but it also helps organizational success and they're by country wide development.

In this research study, it is revealed that university students are influenced by other factors than their free choice when selecting career field, especially parental influence. Therefore, it recommended that Sri Lanka as a country should develop proper career guidance programme for students from their young ages. These programmes must also extend to the parents. This will give opportunity to parents to help their children to select a proper career that suits for their personality. Government must take initiatives promote proper career guidance programmes for students, especially for the students who lives in rural parts of the country.

If these measures are not taken, nobility of these careers will be reduced; as professionals will seek more materialistic gain than reputation of their career. Higher education systems should also be modernized to develop more internationally marketable graduates in every career field. Many students have expressed that they have left arts and humanities as career field due low demand in the labour market. Thus, arts and humanities should be given the priority in modernization of degree programmes. This will facilitate more freedom in career choice for students.

This study still lies in exploratory nature in the Sri Lankan context. Thus, there are many avenues for further research. Future research should be performed using larger sample of students and universities in order to increase the generalization of the findings. Moderating and mediating variables which were identified through case study analysis must be inculcated in to the future research studies on this topic. It is also recommended to perform similar study to real professionals who practice the relevant profession than students who are mediated with academic and peer socialization. Finally, a longitudinal study taking sample of advanced level students and studying their personality until they enter in to a permanent job will be ideal to assess the personality development of a person and how it relates to career choice.

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# Market Efficiency and Related Theories: A Brief History

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**Abstract**—This paper mainly focuses on reviewing the theoretical phenomenon with regard to market efficiency. The paper lays the background for the analysis by elaborating the theory of Efficient Market Hypothesis; a theoretical phenomenon brought forward by E. Fama and explained under three different market forms; Weak form, Semi-strong form and Strong form. Each of the different form is elaborated with empirical findings, which both support and oppose the theory. Review it further extended to elucidate other related concepts such as Random walk theory and different Market Anomalies.

**Keywords**—Efficient market hypothesis, Market Anomalies, Political Events

## I. INTRODUCTION

The concept of Market efficiency was one prominent concept tested by number of researchers and evolved back in 19<sup>th</sup> century with the study by Working [1], Kendall and Hill [2], Horne et al. [3], E Fama [4] and many more. An important contributor to the study, Eugene F Fama through a series of studies on market efficiency developed a well structured framework; Efficient Market Hypothesis. Fama [4] assembled a comprehensive work on market efficiency and defined an efficient market as “one in which trading on available information fails to provide an abnormal profit”.

The topic was hot during the 19<sup>th</sup> century, motivating number of researchers to test the hypothesis in different markets, leading to a vast body of knowledge. This paper summaries the theory behind the market efficiency in a sequential order with reference to the oldest and some latest studies with the objective of briefing out the 1 of studies conducted in this area. Author’s purpose is not to test the validity of the methodologies used by different researches, but to draw attention to the empirical finding theories under market efficiency.

The discussion is structured based on the level of importance given to each theory under market efficiency. Accordingly, first I will elaborate the Efficient Market Hypothesis by giving prominence to the three forms of market efficiency. Second, the Radom Walk Theory will be detailed out and thirdly a briefing on market anomalies which will be followed with the concluding remarks.

## II. EFFICIENT MARKET HYPOTHESIS

The study of Efficient Market Hypothesis was a blistering topic among researcher and journalists during the 19<sup>th</sup> century. In the most simplest version Eugene F Fama through his prominent journal article on capital market efficiency explained market efficiency as follows; a situation in which prices always “fully reflect” available information [4]. Basu [5] introduced the EMH concept as, reflecting

information through security prices “in a rapid and unbiased fashion...”, so that the security valuation gives an unbiased estimation of the underlying values of securities. Moreover he questioned the validity of the hypothesis irrespective of the number of studies which support the same.

Jensen [6]elaborates a more sensible version of hypothesis; the prices reflect information to the extend where the marginal benefit does not exceed the marginal cost of information. Grossman and Stiglitz [7], argues market efficiency as a situation where the cost of getting prices to reflect information equals to zero. Yang et al. [8] simplifies the concept “informationally efficient”, as share prices moves as soon as the new information is announced. Burton G Malkiel [9], explained market efficiency as incorporating the market information and news spread in to the stock prices without any delay. Thereby, neither technical nor fundamental analysis allows the investors to gain through returns greater than those that could be obtained by holding a randomly selected portfolio of individual stocks. Yang et al. [8], expatiate on a different view of efficient market hypothesis. As per the authors efficient market hypothesis is an extension of the economic concept “Invisible hand” developed by Adam Smith. The efficient market hypothesis believes the share prices as a balance between the supply and demand conditions of the market. If the market is not balanced at a particular point, then the investor’s buying and selling behavior will move the market in to balance in no time.

The developer of EFH, Fama [10] has elaborated the EMH as a clean benchmark that allows to understand what are reasonable information and trading costs, while classifying the extreme version of the theory as false. He further states the theory should be tested jointly with some other model – asset pricing model and not testable individually. Schwert [11], unfold market efficiency using market anomalies. According to Schwert anomalies can be defined as “empirical results that seem to be inconsistent with maintained theories of asset-pricing behavior”. Anomalies show either market efficiency or lack of accuracy in the model used. He further highlights the fact that after documenting and analyzing the anomalies, they seem to disappear from the market. With this interesting finding of Schewert, now the existence of market efficiency was questioned. Most recent studies done by Hussain et al. [12] ,



suggests the present prices absorb and adjust to the latest information thereby, replicating the whole existing information through present prices. As per the existing theory, unless otherwise on few lucky events investors are unable to constantly outperform the market with a set of already known information.

#### A. Weak form efficiency

To begin with EMH, theory comes up with three information subsets; weak form test, semi-strong test and strong form test, based on the availability of the past data, publicly available data and any other information upon which investors have monopolistic access [13]. Fama used the market equilibrium as the model for testing the efficiency. It is a model that specifies the nature of the market equilibrium when prices “fully reflect” available information and the conditions of the market equilibrium can be stated in terms of expected return. Fama [13] explained weak form markets as when the information set is just historical prices. As per the findings, weak form test is strongly supported by the empirical evidence.

On the other hand, Malkiel [14] explained Random walk theory as a certain portion of weak form market efficiency. Further he explained the theory as follows; “a blindfolded chimpanzee throwing darts at the Wall Street Journal could select a portfolio that would do as well as the experts”. In a recent paper Malkiel [9] has further explained random walk as “...not literally to throw darts, but instead to throw a towel over the stock pages”. In other words he advised to buy a very board-based index funds rather than creating a narrow index fund. In a separate study by Hussain et al. [12], a test of weak form market efficiency of the stock market returns of 14 emerging equity markets of Asian-Pacific region, found that no market is weak form efficient; thereby concluding it is possible to gain through arbitrage benefits due to the market inefficiencies inherent in these markets. Poshakwale [15], a study based on Bombay Stock Exchange, concludes that the series of prices follow a non-random nature, thereby violating the weak form market efficiency whereas the weekend effect was evident in the Bombay Stock Exchange, as returns achieved on Friday are significantly higher than the returns of other six days.

Dickinson and Muragu [16], support the EMH through a study based on Nairobi Stock Exchange. They concluded that small markets like Nairobi, can not specifically categorize as weak form efficient, rather the empirical results does not contradict with the theory. Further, the study was concluded with a suggestion to use a lengthier time interval and variety of methodologies to come in to a strong conclusion regarding the weak form efficiency.

Jarrett [17], a study on daily variations in four emerging Pacific-basin stock markets concluded that due to the difficulties of emerging markets to achieve efficiency in their capital market, weak form efficiency does hold for these countries. Further to this, Jarrett examines the existing literature on USA, UK and other developed markets, in

which the weak form of EMH cannot be rejected, since these market are mature and more complex than the small emerging markets.

#### B. Semi-strong form and Strong form Efficiency

Semi-strong form market as explained is where the stock prices reflect all the publicly available information such as announcements of annual earnings and stock splits etc. [13]. Poshakwale [15] expatiates semi-strong efficient when the stock prices instantaneously mirror any new publicly available information and strong form efficient when prices mirror all public and private information.

Groenewold and Kang [18], tested the weak form and semi-strong form efficiency in the Australian share market using monthly stock returns. They state that semi-strong EMH indicates that share price movements cannot be predicted based on the publicly available information and have pointed out two types of tests; based on macro data (e.g. inflation, money stock, exchange rates) and micro data (e.g. company specific announcements). Study concludes the Australian share market during 1980s was found to be in line with the EMH.

Hussin et al. [12], examined semi-strong form efficiency of the Malaysian Stock Market to a combination of dividend and earning announcements. The dividend announcements were strongly reflected through the stock prices supporting the semi-strong theorem. Overall the results signify the time required to absorb the information passed through dividend and earnings announcements is extensive, therefore Malaysian stock market is near efficient in semi-strong form for these types of announcements.

Strong form efficient as per Fama [13], concerns whether investors have monopolistic access to any information relevant for price formation. Fama [10], through his second study reworded the strong form test as “test for private information” and semi-strong form as “event studies”. Further he states that cleanest evidence on market efficiency come through event studies and share prices are more sensitive towards the firm specific information. The literature lacks studies on strong form efficiency or private information. Accordingly, the tests on private information by Wall Street journal analysts “Heard on the Street” column are statistically reliable but small.

The basic assumption bought-out by many studies so far is, that the response to an event is short-lived. Therefore, most studies have been carried out by observing the stock performance within a very short time span. Fama [19] stated, there is a developing literature which disagrees with this basic assumption, rather stock prices adjust slowly to the information, therefore one must study the stock performance over a long time span. As per the developing literature, the markets are inefficient in the long run. However, Fama in his studies disagrees with the same due to two reasons. Firstly, since both the under-reactions and over-reactions are frequent occurrences in an efficient market, splitting these

two anomalies randomly make it consistent with the market efficiency. Secondly, the long run anomalies tend to disappear when applied in to different models, as a result long run anomalies can also be consistent with the market efficiency [19].

### III. RANDOM WALK THEORY

Kendell and Hill [2] inspired by the findings of their study based on 22 UK stock and commodity price series, which showed almost zero correlation between different price changes. The paper concluded; "*in series of prices which are observed at fairly close intervals the random changes from one term to the next are so large as to swamp any systematic effect which may be present. The data behave almost like wandering series*". The finding contradicts with the traditional notion, which has been bought up about the market price changes and labeled as "Random Walk Theory". Scenario further explained by Malkiel [14] through his book "A Random Walk Down Wall Street". Further studies by Malkiel [9] elaborated the meaning of Random Walk as, a random departure of share prices from the previous prices. The fundamental logic behind the concept is, if the prices are immediately adjusted to the market information, then tomorrow's price will react to tomorrow's news only, and will be independent from today's price changes. But news by definition is unpredictable making the price changes unpredictable and random. Lo and MacKinlay [20] rejected the hypothesis of true random walks in the short run. Lo, Mamaysky and Wang [21] further illustrated the use of technical analysis such as head and shoulders and double bottoms to understand the stock price patterns in the short term. Jarrett [17] suggests that "... a daily variation is neither random nor stochastic", therefore there is a possibility to predict the price patterns to a certain extend. A study based on NY stock exchange to test the random movement of stock prices, supports the theory of Random Walk. He further states the intrinsic value of a stock is based on its expected future cash flows, and as and when there is new information, investors may react to the same, leading to a revision in market prices, which takes place in a random pattern [3]. Konak and Seker [22], in a recent study checked the theory during the global financial crisis, from 2001 January to 2009 November within FTSE 100, a developed and matured stock exchange. Study concludes existence of weak form and random walk in FTSE 100 during the financial crisis period. Empirical evidence validate the random walk in number of other developed markets such as Johannesburg Stock Exchange [23], Australia [24].

Above all the supporting evidence for the Random Walk, there were occasional instances where prices series tend to follow a pattern. Findings of Working [1] confirms non-random walk of market prices.

### IV. MARKET ANOMOLIES

Market anomalies on the other hand support to enhance the market predictability of an investor. Interestingly as per Schwert [11], market anomalies such as value effect, size

effect, weekend effect, dividend yield effect and small-firm turn-of-the-year effect lost their predictive power after publishing the research paper that made these concepts famous and faded away from the markets. This is as a result of the investors and professionals who make use of the anomalies to gain abnormal returns. Jensen [6], agreeing to the same concluded his study stating there can be more anomalies during the several years to come with the market changes.

### V. CONCLUSION

Accordingly, the Efficient Market Hypothesis is a theoretical base, which explains the market structure based on the information availability and accessibility in the market. The theory became the prominent explanation during 1970s. Even today number of studies supports the existence of EMH in different forms out of which Weak form is the most common type of efficiency in most of the markets, whereas Semi-strong form efficiency can be seen in most of the mature and developed markets. Strong form efficiency lacks empirical support. Random Walk Theory is another theoretical back given to explain the price movements which are difficult to explain with certain identified pattern, and been strongly supported by findings. Stock market anomalies are only too often chance events that do not persist into the future. Thereby, the theories of market efficiency continue to provide a clear framework to explain different market structures.

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# A Case Study On Customizing The Microsoft Time Series Algorithm: Tourist Arrival Prediction

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**Abstract**— As far as tourism is concerned in Sri Lanka, it is considered as one of a lucrative industry for the country. On the other hand, in the modern computing era business intelligence plays a revolutionary role in uplifting the profits of business organizations. The research is about how the Microsoft Time Series algorithm can be improvised to predict the arrival of tourists. The algorithm employed for the tourists who arrived for Sri Lanka in past few decades. Furthermore, this study discusses the drawbacks of the existing Microsoft Time series algorithm concerning the consideration of the external factors which affects the prediction. Also, this study discusses some of the possible solutions to overcome that issue.

**Keywords**— *business intelligence, tourism, tourist arrival prediction, Microsoft time series algorithm*

## I. INTRODUCTION

In the modern computing era business intelligence plays a revolutionary role in uplifting the profits of business organizations. Business intelligence can be used to utilize the vast amount of data, which is stored in organizational databases in favor of the organization. The research paper focuses on applying Microsoft time series algorithm for the tourism industry. The research includes the steps taken to apply time series algorithm to predict the arrival of tourists and how the algorithm can be improved to make the predictions more comprehensive.

## II. LITERATURE REVIEW

As far as the tourism industry is concerned, tourism prediction for the upcoming years plays a significant role for the respective countries. Therefore the researchers have produced a reasonable amount of findings concerning the prediction of tourism demand in various perspectives.

According to the study of US tourism demand to Durban (Burger &, 2000), a precise comparison among various prediction algorithms has been made, and the accuracy of the algorithms was also well presented. The accuracy of the models was assessed through Mean Absolute Percentage Error (MAPE) and the correlation coefficient (r) value. Moving average model, naïve, ARIMA models, multiple regression model, genetic regression and the neural network were the models which the study took into comparison. Monthly basis Tourist visits from the US to Durban from 1992 to 1998 was the data set, where the models were tested. According to the research, the best performing algorithm was the neural networks with the highest (r) value of 0.979 and with the lowest error value (5.07%). While the above

research was carried out to find the best performing algorithm to forecast the tourism arrivals another research (Noersasongko & Julfia, 2016) was focusing on the optimizing the prediction algorithm. An interesting thing to point out is, the best performing algorithm of the previous research was selected for the optimization part of this study. As stated in the study, neural networks consist of specific parameters such as momentum, learning rate and training cycle which needed to be adjusted manually. As a solution, they have optimized the algorithm using the genetic algorithm. The optimized algorithm was applied to the tourist who visited central java from 1991 to 2013. The optimized neural network algorithm had performed well than the general neural network algorithm by returning a less error percentage.

Another researcher Song et al (2011) from the school of hotel and tourism management of the Hong Kong Polytechnic University emphasize the importance of seasonality and time-varying parameters for the time series algorithm. The study has been carried out with the purpose of integrating Structural time series model (STSM) and time-varying parameter (TVP) regression model. STSM model is capable of understanding the trends, seasonality and cyclic components of a data set. Also, the time-varying parameter is capable of determining the variables, which vary with the time and how it affects for the prediction of the tourist arrival. The integrated model was employed for quarterly tourist arrivals to Hong Kong from four key source markets: China, South Korea, UK, and the USA. The research says that the new model (the integrated version of STSM and TVP) performs well along with its competitors. While the research of integrating STSM model with TVP model addressed the seasonality and the time-varying parameters factors for time series model for tourism, a much more similar study (S. & A., 2015) published in the Balkan journal of electrical and computer engineering describes the effect of seasonality factor for tourism in a different dimension. The particular research emphasizes that the consideration of seasonality in a deterministic manner provide more accuracy than stochastic component. The previous research was carried out by considering seasonality in a stochastic manner.

The studies mentioned above were considered in before developing the case study for the improvised algorithm to predict the arrival of tourists.

### III. METHODOLOGY

As the very first step, it is essential to go through the ETL (Extract, Transform, and Load) process of data. Most commonly it is the first step in creating a data warehouse. ETL provides a comprehensive way of structuring the data as per the requirements. The steps are clearly explained below.

#### A. Extracting Data from reliable sources

As this research is based on the data, a considerable amount of past data is required to predict the future. Therefore, the amount of data is a critical factor for the success or failure of this project. The dataset was taken from the information and statistics published by the official

website of Sri Lanka Tourism Board. (SLTDA) The data were extracted from the annual report which is published by the tourist board at the end of each year. (Anon., 2018)

Considering the data which is available; following information was finalized as the facts to be predicted.

- Predict the arrival of the tourists against the month. Availability of data: past 45 years of data against each month.
- Predict the monthly tourist arrival against the country. Availability of data: past four years of monthly data against significant tourist markets.

The raw data that was extracted from the annual report was featured as shown in figure 1. The following data set was used to predict the arrival of tourists.

A	B	C	D	E	F	G	H	I	J	K	L	M
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1971	5,931	6,570	5,166	1,539	952	961	1,897	2,467	1,881	2,585	4,003	5,702
1972	5,762	5,848	5,564	3,091	3,282	2,302	3,703	4,634	3,402	4,476	6,155	7,828
1973	9,386	8,343	7,875	5,468	4,168	3,246	5,919	6,680	4,184	5,977	7,137	9,505
1974	10,915	9,648	9,847	6,400	3,241	3,303	5,404	6,147	4,986	6,199	8,338	10,583
1975	11,740	10,388	11,158	5,890	5,587	4,787	5,925	8,565	5,287	7,622	11,271	14,984
1976	15,627	15,214	13,431	8,886	6,097	4,550	4,278	3,481	6,707	10,636	13,600	16,464
1977	17,569	18,064	18,216	9,891	7,602	5,536	9,881	11,129	7,594	11,541	17,106	19,536
1978	23,114	22,427	20,497	11,545	8,803	7,134	13,252	15,542	10,245	14,340	20,759	24,934
1979	28,366	25,226	25,472	18,847	13,042	10,674	16,801	20,203	14,798	19,376	25,743	31,616
1980	36,108	33,896	34,416	21,806	19,468	15,082	22,986	27,440	19,962	23,646	23,988	37,982
1981	45,168	39,384	38,376	28,568	21,642	16,836	28,266	32,788	24,086	27,030	29,512	39,086
1982	40,932	40,148	42,178	29,606	28,972	25,772	30,942	34,332	29,754	30,296	33,748	40,550
1983	49,104	44,018	44,710	32,556	32,850	24,350	25,132	8,430	10,050	16,410	20,570	29,350
1984	33,546	32,406	32,628	23,684	18,224	17,866	26,694	27,626	21,764	25,800	27,906	29,590
1985	28,814	27,012	29,886	19,778	14,014	11,092	18,362	20,138	15,242	18,176	23,218	31,724
1986	32,890	30,512	28,932	19,262	13,100	9,536	12,330	15,190	12,398	12,732	18,114	25,110
1987	25,446	23,714	22,838	16,238	8,204	7,650	10,200	11,408	10,072	12,146	14,188	20,516
1988	20,400	19,150	19,430	13,834	11,124	11,540	17,660	18,670	14,980	16,742	10,560	8,572
1989	12,962	12,344	16,032	12,312	12,750	11,630	15,194	17,220	14,264	15,050	18,948	26,026
1990	26,592	26,368	26,946	22,788	18,286	18,050	26,410	26,786	22,438	23,060	24,596	35,568
1991	28,932	28,080	27,153	20,541	17,745	17,394	30,645	28,824	24,762	25,173	28,272	40,182
1992	35,730	38,859	33,399	28,410	21,024	23,157	33,771	40,143	29,838	32,079	35,967	41,292

Fig. 1. Raw data from the annual report

The above data sheet was uploaded to the SQL Server database as it is.

Figure 2 shows the data, which was extracted to predict the region-wise arrival for the upcoming months.

Results		Messages													
	id	Residence	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	1	NORTH AMERICA	5177	4166	4795	3238	3686	6293	7018	5006	3358	4226	5798	6475	
2	2	Canada	2433	2252	2453	1660	1924	3350	4055	2457	1490	1894	2542	2819	
3	3	U.S.A.	2744	1914	2342	1578	1762	2943	2963	2549	1868	2332	3256	3656	
4	4	LATIN AMERICA & THE CARIBBEAN	311	119	119	82	61	72	98	135	133	148	170	178	
5	5	WESTERN EUROPE	36497	38364	39813	25018	15596	17314	41584	32656	22327	24303	35892	43699	
6	6	Austria	1049	1359	1259	521	168	132	667	398	240	398	877	923	
7	7	Belgium	1388	1097	1112	995	232	378	1773	978	647	505	1221	997	
8	8	Denmark	1534	868	992	389	161	371	989	281	145	341	651	1601	
9	9	Finland	1109	993	634	195	116	154	193	110	98	177	319	742	
10	10	France	4782	6378	6519	4533	3225	2267	6189	5473	3030	3475	5441	5551	
11	11	Germany	5933	7654	7865	4645	2930	3054	5852	6162	4942	5385	8161	9059	

Fig. 2. Data used to predict the region-wise arrivals

### B. Transformation of data and rationale behind the transformation

Transformation is considered the second step of the ETL process. The general objective of transformation is to modify the existing state/ format of the extracted data. The ultimate reason to transform the data in this context is explained below in detail.

As specified in the initial documentation of the Microsoft time series algorithm (Guyer & Rebeler, 2017), there are some mandatory requirements for the data set, in order to create a time series model to be predicted with Microsoft time series algorithm. The requirements are as follows.

#### ➤ A Single Key column

This column refers to the case column which defines the time slices of the model. Most probably this will be a Date column. Also, it is stated that the key column cannot have its values in two columns. For instance, the month column and year column cannot be stored in two columns.

#### ➤ A predictable column

Each model should contain at least one column to be predicted. The column should contain continuous values such as the number of sales, income, etc.

#### ➤ An optional key column

In a scenario that there is sales information for past months against the name of a product, we can define the product name as another key value in the model.

When comparing the requirements which are stated above with the available data; there is a huge modification needed to be done in order to predict the future arrivals with Microsoft Time Series Algorithm. The drawbacks of the data sets shown in figure 1 and figure 2 are listed below.

- There is no single key column as the month and the years are in separated columns. Therefore there is a

need to create a single key column using the existing data.

- There is no proper column to be chosen as the predictable column. Since the number of arrivals is spread across the columns, there is a need to make one column which contains all the arrivals separated by rows.

When considering the above factors, unless a proper transformation of data did not happen, there is a difficulty in processing the mining model to get the predictions.

In order to transform data from the available format to the format which is required, some heavy T-SQL queries were used. As a result of that, the data were appropriately formatted as per the requirement of Microsoft documentation.

### C. Justification of the selected algorithm.

As this research focuses on the forecasting the arrival of tourists who are coming to the country, the algorithm plays a vital role with regards to its accuracy. Since the Microsoft technologies are chosen to predict the arrivals, there is a uniqueness in selecting the most suitable algorithm. The reason behind that is, all the competing algorithms against the Microsoft Time Series Algorithm resides within the algorithm.

According to the technical reference (Guyer, 2017); Microsoft time series algorithm has the characteristics of two algorithms, namely ARTXP (which is commonly known as Autoregressive Tree Model for forecasting) and ARIMA (which stands for Autoregressive integrated moving average) algorithm. Furthermore, it is stated that ARTXP is more suitable for the short-term prediction and the ARIMA algorithm is more suitable for the long-term prediction. Thus it is clear that there are two separate flavors of algorithms are integrated to the Microsoft time series algorithm, so that the most appropriate algorithm should be chosen among those flavors.

In order to apply the desired flavor of the algorithm, there is a particular parameter named exponential smoothing where

we can assign a value for the parameter between 0 to 1 ranges. By default, the value is set to 0.5, and upon increasing the value until one, there will be more ARIMA characteristics added to the algorithm which is used for long-term prediction. Also when decreasing the value from 0.5 to 0, the algorithm will be more suitable for short-term prediction which consists of ARTXP characteristics.

In order to choose the most suitable smoothing of Microsoft time series algorithm, the mining model was processed under three categories. In other words three types of algorithms. The types were as follows.

- Under ARIMA conditions.
- Under ARTXP conditions.
- Under a mix of both ARIMA and ARTXP conditions.

In order to test the model against those three conditions, the prediction smoothing parameter was set to 0.7, 0.3 and 0.5 to test against ARIMA, ARTXP and the mixed condition respectively.

#### D. The number of year's factor for accuracy.

When considering the accuracy of the prediction results there can be various factors which affect the accuracy. Since there were data on the tourists which collected on a monthly basis from the 1970's, there were nearly 40 years old data. In such a considerable period, the arrival trends might be changed gradually, and when the model consists of all the past data, it may also be affected by the accuracy of the algorithm. Considering that factor each of the above algorithms was tested against five years old data, fifteen years old data, and 35 years old data.

In order to measure the accuracy of the algorithms, the MAPE value was calculated manually to find out the Mean Average Percentage Error. Even though the other Microsoft data mining algorithms automatically provides an accuracy chart of the mining results, Time series algorithms do not provide any mechanism for testing the accuracy of the results. Therefore the following formula was used to calculate the MAPE (D.Lawrence et al., 2009) for the above-explained instances and then figured out the model with the least error percentage, as the finalized model for the predictions.

Formula:

$$100(\sum(|x_i - \hat{x}|) / \hat{x}) / N$$

Where,

$\hat{x}$ : is the actual observation in the time series.

$x$ : is the forecasted value

$N$ : is the number of non-missing data points.

#### E. Test Results

The error percentages which is recorded in Table 1 were the findings after each of the processed models. In order to check the accuracy, it is essential to compare the forecasted value with the actual value. The models were processed till the year 2015 and predicted the arrival for next 12 months in 2016. Since there were actual values for the year 2016, the MAPE calculations were done with those values.

	ARTXP(0.3 smoothing)	ARIMA(0.7 smoothing)	MIXED(0.5 smoothing)
5 years of data	6.375209	6.64938	6.483517
15 years of data	7.516138	8.362102	7.932715
35 years of data	8.664236	10.30211	9.635457

TABLE 1 MAPE VALUES

When looking at the above results, regardless of the type of algorithms that used; it is clear that the number of years of past data impacts the accuracy of the results. Therefore always better to restrict the amount of past monthly data to a maximum of five years because the error percentage is low when the number of past data is analyzed for a shorter period.

When considering the best algorithm among the three types, the lowest error comes from the ARTXP algorithm which has the error rate of 6.375209.

Therefore it is decided to train all the models with the above constraints where the model has only the past five years of data and the algorithm to be used as ARTXP( Auto-Regressive Tree Model).

#### F. Creation of models and processing models.

After successfully selecting the algorithm which can be used to the prediction, the two models were created using the Microsoft Time Series algorithm with ARTXP conditions. The models were as follows.

- Model for the Monthly arrival of tourists to predict the future arrivals.
- Model to predict the future arrival of tourists with regards to their country.

Moreover, then the models were successfully processed. In order to complete those tasks, SQL Server Data Tools was used.

#### G. Retrieve the predicted values using Microsoft Analysis Services.

Soon after the models were processed, the models were accessed using SQL Server Analysis service, and DMX (Data Mining Extension) queries which were related to the Microsoft Time Series algorithm.



## IV. DISCUSSION

This section is intended to discuss the innovation section of the research by profoundly analyzing the existing implementation of the algorithm used to predict the arrival of the tourists.

#### A. A Brief Look at the existing features of the Microsoft Time Series Algorithm.

As far as the Microsoft Time Series algorithm is concerned, the algorithm itself is an already customized version of two predictive algorithms. In the SQL version 2005, the ARTXP (Autoregressive tree model) algorithm was introduced for the forecasting time series data. Later with the SQL server 2008 version, ARIMA algorithm (Autoregressive moving average) was introduced in order to improve the long-term prediction of the algorithm.

As the versions of SQL server increases, the algorithms also provided a certain number of parameters which can be customized according to the needs of the data sets. As an example "missing value attribute" parameter helps to replace the values which are not available in the original data set. "Periodicity hint" parameter is another such parameter where the algorithm can understand the periodicity of the data set. Such parameters were an asset to this project as both of those parameters were used when creating the models. Since some of the countries did not have arrivals for a period the "missing value attribute" parameter was used to overcome that problem. "Periodicity hint" parameter was specified as 12 for each of the models which were created because the tourist data vary by each year. Therefore the use of an already customized algorithm gave such benefits for the project by minimizing the errors which can be seen in non-customized versions of predictive algorithms.

One of the other essential aspects of the algorithm is the ability to interact with the processed models directly using Data Mining Extension queries. (DMX) Microsoft analysis services support DMX queries, and that was also used in this project to quickly retrieve the future prediction of the arrival of the tourists. DMX queries which are specified for

the time series algorithm gives a range of functions to retrieve various information about the processed mining model. As described in the methodology section, predictTimeSeries is an inbuilt function which was used to retrieve the future values of the tourists to arrive.

#### B. Identification of drawback in the existing algorithm

As the DMX queries which are specific to Time Series Algorithm provides various features, it provides the ability to extend the existing time series using the EXTEND\_MODEL\_CASES keyword. That keyword can be used to implement a What-if scenarios feature. The feature can be used by the users (probably a top-level manager engaged in the tourism industry) to change the current prediction for a given month and evaluate how the arrivals for the following months can be affected or changes according to the changed value. Furthermore, the feature will be a beneficial option when un-expected drops happen in the tourist arrival for a particular period in the country. Hence the decision makers can have alternative plans for the particular period as well.

Although the what-if scenario feature can be implemented as explained above, there is an issue in the accuracy of the results. Moreover, the issue is not because of any technical error. It is the point which this research emphasize as the drawback of the algorithm. When using the Extended Model Cases parameter to replace an already predicted value, the model considers that value with all the previous values. As an example, a model which contains five years of past data has predicted values for upcoming years; if the extended model cases parameter were applied, the model would extend the prediction as a continuation of all the five years. It is the point where the accuracy fails. The accuracy fails not because of any technical reason. The accuracy fails because the algorithm fails to consider any external factors which affect to the prediction. Some test results are displayed in the following figures.

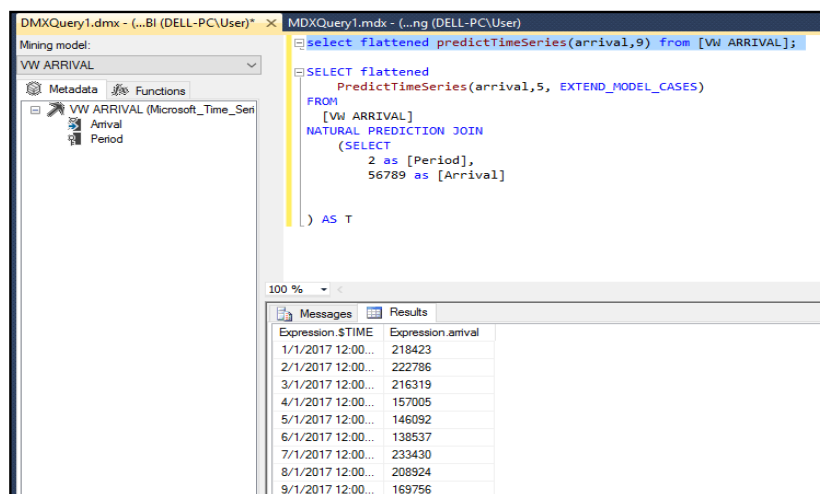


Fig. 3. Predicted values for 2017

The above results in figure 3 show the already predicted values for 2017 based on the data from 2012 to 2016. Moreover, figure 4 shows the extended version of the prediction where the month of January arrival is replaced by

a different value. A comparison can be made on how the future values got changed because of the new value replaced in the January month. Somehow the new values can be



seen in the following figure.

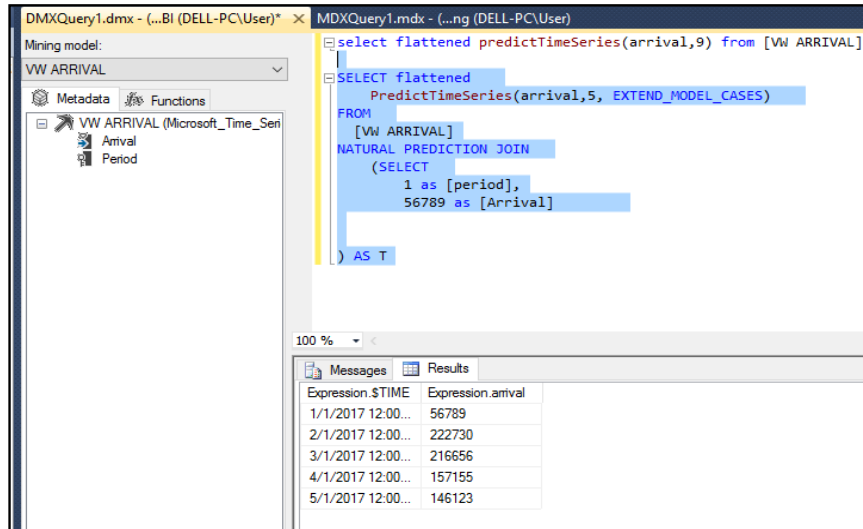


Fig. 4. Extended version of the prediction

trends occurred in a particular period. According to the research paper of the Auto regression tree model of the Microsoft, it mentions that in order to predict the future values there is a phase to learn the trends in the past. When comparing that algorithm with the current issue, a learning phase is mandatory to understand the trends, which were occurred during a circumstance in the past. The

In a situation of external circumstances such as viral diseases, natural disasters or red alerts imposed for tourists who come to the country, the predicted value will be changed notably. Therefore in such a situation, if a user wants to use this what if feature which is built using extended model cases that will be a much failed attempt. The following figure shows an instance where the extended model cases were tested by applying a shallow value for the arrival compared to the average values.

When considering the above factors, it is clear that the algorithm is making a mistake by ignoring the external factor consideration.

#### J. How to overcome the issue.

There can be different forms of solutions be presented to minimize the drawback which is explained above. This research suggests overcoming the issue by considering the external factors to extend the time series prediction. A question can be raised that how the external factors can be considered in order to predict the future values. The solution is to learn from the past technique. As an example, if the country suffers from a natural disaster, hence the tourist arrival might be dropped for a few months. In such a situation the algorithm should have a capability to understand how the tourist arrival was affected in a similar situation in the recent past. Furthermore, in case any similar type of disaster took place in the past, the algorithm should be capable of looking back at the trends of the tourist arrival at that particular period. Soon after, a similar type of trend should be applied to the current situation as well.

#### K. Assessing the possibility of implementing the proposed solution.

As mentioned in the previous chapter, the proposed solution for the issue requires the algorithm to learn the previous

technical reference of the algorithm indicates that the autoregressive tree model learns about the past by applying the learning techniques to multiple prior unknown states. Therefore if customization can be done for the autoregressive tree model, in order to learn a particular period, the external circumstances also can be considered by going through the similar period in the past.

#### L. Challenges.

The proposed model needs customization for the autoregressive tree model implementation. When implementing it practically, there can be practical issues to be dealt with. One such challenge is explained below.

- Determining the data model

In the prior sections of the discussion chapter, it was discussed to learn about the specific past data to understand the trends and apply the same trends in the current situation. If so, a question can be raised as; should the data model consist of all the past data, including the data which is going through the learning part? As discovered in the justification of the algorithm, the amount of past data which data model consists also have an impact on the prediction of the algorithm? Therefore if the learning part of the data is far before the current year and if the data model should contain all the data to identify the specific trend, there may be issues in the accuracy of the results. So that those type of challenges needed to be addressed.

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# The Determinants of Personal Solid Waste Management Behaviour of Colombo District Residents

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**Abstract**—Current study focus on proposing a model to capture personal solid waste management behavior of Colombo District consumers in Sri Lanka. The model was developed based on the theory of planned behavior proposed by Ajzen (1991) and the solid waste management hierarchy (SWMH) model proposed by McAllister, (2015). The study will elucidate on a ground level practical approach to solve solid waste management issue in Sri Lanka.

**Keywords**—individual, solid waste management, social norms, personal norms, situational factors, satisfaction

## I. INTRODUCTION

Consumption is a foremost aspect in consumer lifestyle and disposing waste is an inherent aspect of consumption. Many scholars have defined consumer behaviour as a systematic investigation of persons, set of persons, organizations and processes that those entities deploy to choose, retain, consume and to dispose. Solid Waste Management (SWM) is the root level solution for improper waste disposal.

Nathanson, (2017) has proposed that solid waste management has a lengthy and complex history. The history of (SWM) is going way back to ancient Greek time (McAllister, 2015). As he postulated, greeks in 4th century A.D. had faced to challenges with waste removal due to growing population, limited land resource and hygiene problems. Lately, in 14th and 16th century societal and political issues were not significant in (SWM) and initial waste management procedures were established to mitigate unhygienic municipal conditions (McAllister, 2015).

In year 2017 (SWM) issue heavily affected to Colombo district, Western province. The disaster took place in Meethotamulla garbage dumping site, located in a heavily urbanized area in Colombo district, aroused due to irresponsible consumption and improper solid waste management (Petley, 2017; Wijenayake, 2017; Ministry of Defense-News, 2017). As per above information sources, this disaster of solid waste has buried nearly 145 houses and 31 citizens under the compact garbage. As cited by Ranasinghe, (2017) from Hardin (1968), 'the tragedy of commons' has explained the root level solution of (SWM) which is personal solid waste management behaviour. He has explained that, every person has to contribute to keep away the danger, while individual has incentive not to contribute which is coined as 'Prisoner's Dilemma'. To articulate a sustaining solution for Solid Waste Management (SWM) problem in Colombo district, it is

essential to take a micro level approach to identify what are the determinants of personal solid waste management behaviour.

## II. RESEARCH PROBLEM

As per Central Environment Authority, (2008), 'Pilisaru-2008' project proposal revealed that, an average citizen in Colombo municipal council generate 0.8 kg of solid waste. Furthermore Wijenayake, (2017) has postulated that currently 700 metric tons of solid waste is collected from Colombo municipal council and 1200 metric tons are gathered from rest of residential areas such as Mt. Lavinia, Nugegoda, Moratuwa, Rathmalana, Kaduwela, Ja-Ela and Kolonnawa on daily basis because of nearly 1kg of solid waste from a resident in Colombo District.

In contrast, Central Environment Authority, (2008) has revealed that only 58.5% of solid waste was collected from local authorities and rest were buried or dumped into garbage sites which caused to build mountains of garbage which naturally became compost with time. Besides Wijenayake, (2017) and Ranasinghe, (2017) claimed that Meethotamulla, Bluemendhal and Karadiyana were result of excessive solid waste dumping contributed from individuals. For instance, it is required to take a proper approach to overcome daily rising solid waste in Colombo district rated as the most solid waste generating district in the county. Rather taking a macro level national approach, micro level individual approach can accommodate solid waste management in Colombo District. Therefore, current study is articulated to find what are the determinants of personal solid waste management behavior of Colombo district residents?

## III. RATIONALIZATION

It is revealed with earlier citations that Colombo district has the highest per capita solid waste generation and massive garbage dumping sites across the country. As per National Building Research Organization, (2017), dumping site of Meethotamulla is covered around 78000 m<sup>2</sup> (approximately closer to 20 acres) with a maximum height of 45-50 m. As same to Meethotamulla, there are huge dumping sites named as Karadiyana and Bluemendhal (which is currently abandoned) have occupied a vast geographical area in

Colombo city and caused to severe health and societal problems.

In economical perspective it is required to study on personal solid waste management behaviour (PSWMB) as a ground level remedial action to minimize national level cost of solid waste management. As suggested by Wijenayake, (2017), in year 2016 government has planned to transport this massive amount of solid waste to Puttalam with cost of 16 billion rupees plus running cost. Furthermore, Silva, (2014) has presented that the complete waste dumping site of Dompe was a Korean government project with 450 million rupees investment and Sri Lankan government has invested 150 million rupees for digging the massive pits for garbage storage. Therefore, (PSWMB) should be stimulated from government to get rid of vast investments in solid waste management which has opportunity cost of developing social infrastructure.

Furthermore with 1.1% growth of population in Sri Lanka (Trading Economics, 2017), the time taken to get expand the volume of Meethotamulla garbage dumping was nearly 2 years (National Building Research Organization, 2017). Based on above given facts and figures, it is established that there is a burning issue to search for a sustainable solution with involvement of individuals for (SWM). Since the study has a solid rationale to find determinants of personal solid waste management behaviour of Colombo district residents as a micro level approach for itself and as an initiative for whole Sri Lanka in Macro level.

#### IV. OBJECTIVES

Objectives of this study was identified as follow

- To identify determinants of personal Solid waste management behaviour of Colombo district residents.
- To identify impact of determinants of (PSWMB) on personal solid waste management behaviour of Colombo district residents.
- To make recommendations for improvement of personal solid waste management behaviour of Colombo district residents.

#### V. SIGNIFICANCE

There are many studies conducted by other academics to identify determinants of personal solid waste management behaviour (Janmaimool, 2017; Frank & Stephen, 2011; Schultz et al., 1995; Vining & Ebreo, 1992; Bohlen et al., 1993). In contrast, there are very few studies in Sri Lankan context with related to the solid waste management (Gunaruwan & Gunasekara, 2016; Malwana, 2008). Furthermore, this study is focused on the behavioural aspect of solid waste management on personal basis as per hierarchy of solid waste management rather taking a optimization model for solid waste management in municipal council level. Additionally, study will provide a model to how to improve personal solid waste management behaviour of Colombo district residents.

Practically, current study can be implemented with Colombo district residents as a root level solution for (PSWMB). Municipal councils can arouse supreme impacting factors on (PSWMB) to ignite engagements for solid waste management on individual basis through a proper mechanism.

Furthermore, as cited by Ali, (2017) from Hoorweg and Perinaz Bhada-Tata, the global expense of managing waste will increase up to \$375 billion by 2025 from \$205 billion in year 2010. Apart from that, Ranasinghe, (2017) has embossed that individuals who reside in Colombo, the highest waste generating district in country, should be responsible for their daily amount of garbage. Meantime, the recent tragedy of Meethotamulla has given symptoms of a heavy societal problem in Colombo district with next decade (Wijenayake, 2017). Therefore, it is required to identify factors which can make individuals responsible for solid waste management and current study suggest those factors what will drive individuals towards this societal problem.

#### VI. LITERATURE REVIEW

##### A. *Solid waste, solid waste management and personal solid waste management behaviour (PSWMB)*

Emergence of solid waste is connected to evolution of people, prosperity and urbanization (Ngoc & Schnitzer, 2009). Furthermore Giegrich & Vogt, (2005) have emphasized that waste creation is associated with level of economic activities. Solid waste can be defined as solid constituents and partitions discarded from man and animals (Malwana, 2008). In addition, waste is defined as substances or elements which are unleashed to the environment since those are not furthermore usable (Kariuki, 2015). Solid waste management is a process aligned to collect and handle waste in solid form (Anand, 2010). As emphasized by Elsaid & Aghezzaf, (2015), Solid Waste Management (SWM) system consist with waste producing, storing, gathering, and conveying, treating, processing, recycling and final disposing. Supportively, Malwana, (2008) has postulated that a proper waste management system is drafted with special attention for waste generation, collection and transportation, immediate treatment and final disposal. Sira, (2010) has presented the same idea that solid waste management is a discipline formulated with generation, control, storage, selection, transportation and disposal of waste. In early academic works, solid waste management hierarchy model also known as 'integrated solid waste management hierarchy and it was proposed as a solution for solid waste management issues (McAllister, 2015; Jones, 2000; Kariuki, 2015).

##### B. *Solid waste management hierarchy (SWMH) model*

Jones, (2000) has revealed solid waste management hierarchy model as a management process aimed at enhancing waste management. At the top of the hierarchy most favored behavior, waste minimization is presented and

least favored behavior, disposal is presented at bottom layer. Jones, (2000) arranged waste management behavior in an order of waste minimization, reuse, recovery (recycling and composting), incineration with energy recovery, processed disposal and disposal. In McAllister, (2015) study (SWMH) model is presented as bottom up approach where bottom of pyramid is allocated for most preferred behaviour, waste minimization and in contrast Kariuki, (2015) has presented waste minimization behaviour at the top of the pyramid.

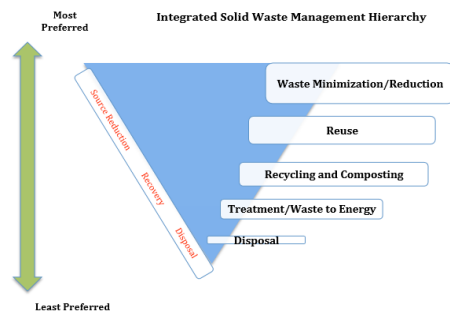


Figure 1: Integrated Solid Waste Management Hierarchy [Source: McAllister, (2015)]

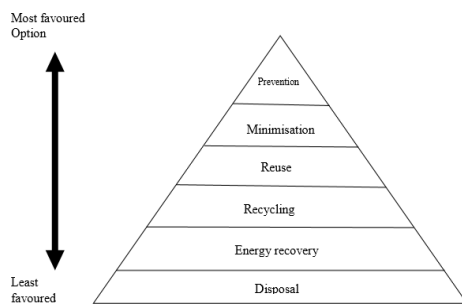


Figure 2: Solid Waste Management Hierarchy [Source: Kariuki, (2015)]

In contrast, the same solid waste management hierarchy has been presented by US EPA, (2017) as non-hazardous materials and waste management hierarchy with four levels in a bottom up pyramid. Most preferred behaviour is source reduction and reuse. Secondly recycling or composting. Thirdly energy recovery and least preferred behavior was treatment and disposal. As per above mentioned solid waste management hierarchy, the desired waste management behaviors should pursue, and undesired waste management behaviors should control by individuals. Therefore, author has diverted the focus of study into personal solid waste management behaviour through hierarchy of solid waste management.

US EPA, (2017) has revealed waste management behaviour is individuals' participation in activities which are focused to diminish the volume of solid waste and to liquefy waste to avoid environmental and health impacts. Furthermore, Janmaimool, (2017) has postulated that non-hazardous materials and waste management hierarchy approaches can be practiced by an individual. Therefore, author has

deployed waste disposal behaviours, green purchasing behaviours, waste avoidance behaviours and reuse and recycling behaviours (Janmaimool, 2017) as indicators of personal solid waste management behaviour. Besides Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA) explain why a particular kind of behaviour is showed by a person through attitudes, subjective norms and perceived behavioural control. It would reveal reasons or determinants of individuals to pursue personal solid waste management behaviour.

### C. Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA)

Theory of Planned Behaviour (TPB) has presented by Ajzen, (1991) which has been adapted by Theory of Reasoned Action presented by Fishbein & Ajzen, (1975). As proposed by Ajzen, (1991), the most recent influencer for an individual's behaviour is intention to do or not to do a behaviour. There are three factors to be considered in assessing behavioural intention.

- Attitudes: a mental sentiment that assess, the evaluation of performing a behaviour is positive or negative (Frank & Stephen, 2011). Extent to which doing a behaviour is positively or negatively valued (Ajzen I. , 2017).
- Subjective norm: an individual's supposed perception regarding societal influence to do or not to do such behaviour (Frank & Stephen, 2011). The apparent societal compression to perform or not to perform a behaviour (Ajzen I. , 2017).
- Perceived behavioural control: the individual's perception of his or her own ability to engage in a behaviour powered by facilitating conditions and self-efficacy (Frank & Stephen, 2011). Persons' perception of their ability to engage in a behaviour (Ajzen I., 2017).

TPB has given a considerable contribution to understand the recycling behaviour of individuals in several studies (Boldero, 1995; Davis et al., 2009; Tonglet et al., 2004). The conclusion of those studies was that perceived behavioural control has a strong impact on behavioural intention to recycling when there is a strong attitudes and strong subjective norms for recycling. Therefore, in current study, the recycling behaviour and other solid waste management behaviours such as waste disposal behaviour, green purchasing behaviour and waste avoidance behaviour (Janmaimool, 2017) are embedded into one construct which concerned as personal solid waste management behaviour (PSWMB). In addition, the model of altruistic behaviour provides explanation how personal norms and social norms will affect to individual's behaviour.

#### D. The model of altruistic behaviour

Schwartz S., (1977) has presented those personal norms which consider as a decent responsibility to perform a task and social norms where the pressure is coming from society affects to the individual behaviour. In contrast he contended that social norms not directly affect to the behaviour of individual and it possesses an indirect impact on individual behaviour through influencing to personal norms. Furthermore, he has presented that 'awareness of consequences' and 'ascription to responsibility' as another two components which moderate relationship between personal norms will and individual behaviour. Figure 3 and 4 illustrate (TPB) and the model of altruistic behaviour.

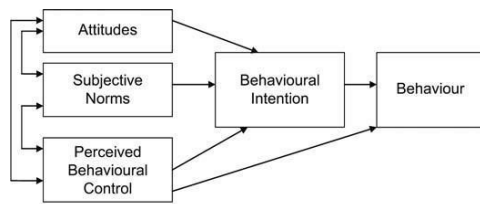


Figure 3: Theory of Reasoned Action (TRA) [Source: Ajzen (1991)]

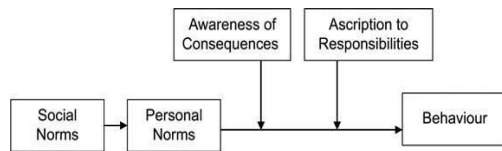


Figure 4: Model of altruistic behaviour [Source: Schwartz (1977)]

Apart from above mentioned factors, there are some indirect factors which affects to the personal solid waste management behaviour. General environmental concerns (Hopper & McCarl Nielsen, 1991; Schultz et al., 1995; Vining & Ebreo, 1992) situational factors (Aceti, 2002; Kline, 1988) and financial motive and reward scheme (Bohlen et al., 1993; Meneses & Palacio, 2006) were identified as other influential factors of personal solid waste management behaviour.

Besides Janmaimool, (2017) and Frank & Stephen, (2011) has studied about the personal solid waste management behaviour throughout their studies while integrating personal norms, attitudes and skills, Social norms and attitudes, inconveniences (situational factors) and satisfaction with service provided for (SWM) as predicting variables of personal solid waste management behaviour. The current study has addressed the empirical gap of testing the solid waste management hierarchy model along with predicting variables adapted from Janmaimool, (2017) and Frank & Stephen, (2011) studies.

##### 1) Personal norms, attitudes and Skills

Schwartz, (1973) has postulated personal norms as a person's moral commitments or state of mind to perform a particular set of actions or behaviors. Furthermore, Janmaimool, (2017) has revealed personal norms as self-standards which are established on person's supposed values

as an alternative of person's beliefs about what society will believe and personal norms are established for every exact action which are concerned as applicable. Besides Kallgren et al. (2000) proposed that personal norms are more powerful than the external forces in governing human behavior. The same ideas have presented by Schwartz, (1970) as social norms are not influential to change human behavior. Additionally, Bortoleto, (2015) has signposted that social norms are altered by individuals and subsequently add as a personal norm, which has more influence on human behavior.

Frank & Stephen, (2011) has also incorporated attitudes and action skill for (SWM) in constructing a regression model for recycling behaviour. The researcher has combined indicators of Frank & Stephen, (2011) and Janmaimool, (2017) to make study more comprehend and precise.

##### 2) Social norms and attitudes

Thøgersen, (2006) has signposted social norms are common identifications about what is to be suitable. Schwartz & Howard, (1981) has argued that social norms can control the individual behaviour through personal perceived possibility for punishment of violating regulations and rewards for compliance. Cialdini et al., (1991) and Cialdini et al., (1990) has postulated that social norms can be divided as descriptive norms which implies personal insight regarding most suitable behaviours displayed by others and injunctive norms which implies personal credence about what behaviours will others morally agree or criticize.

Janmaimool, (2017) has presented self-perception on engagement of general public in waste management behaviour such as waste separation, usage of cotton yarn bags, purchase green products as social norms. In contrast, Frank & Stephen, (2011) has presented social norms and attitudes together in his study as self-perception on society's belief of recycling, local authorities responsibility performance in (SWM) and behaviour of general public for recycling.

##### 3) Situational factors (inconveniences)

Situational factors are defined as reasons support to a group of settings for which an individual has acted or reacted and hold, permitting and restricting influences (Frank & Stephen, 2011). Furthermore, they have signposted that it is essential to identify restriction factors of active participation in recycling to improve active participation for it. Aceti, (2002) has revealed that the individuals, who have a strong belief that recycling is not an easy task, tend to do less recycle or no recycle. No time for recycle, no enough space for recycle, issues due to pests, bad order, proximity to dumping sites are caused to anti-recycling behaviour (Aceti, 2002). In this study, impact of situational factors will be assessed in relation to personal solid waste management behaviour.

##### 4) Satisfaction with service provided from local authority

Kariuki, (2015) has proposed importance of public and private partnerships, public training, institutional framework and enforcement of country by laws have an influence on solid waste management. Through this postulation, it is visible that service of local authority is important for solid waste management behaviour. Besides, Frank & Stephen, (2011) has defined satisfaction of service provided in dimensions of garbage collection, number of bring-in-sites and opportunities to recycle. Furthermore, Elgaaied, (2012) has coined the same idea as perceived facilitating conditions such as availability of necessary facilities for waste recycling and encouragement for inhabitants to recycle their waste. Following research questions are articulated to under the current study

- What is the impact of personal norms, attitudes and skills on personal solid waste management behaviour of Colombo district residents?
- What is the impact of social norms and attitudes on personal solid waste management behaviour of Colombo district residents?
- What is the impact of situational factors (inconveniences) on personal solid waste management behaviour of Colombo district residents?
- What is the impact of satisfaction with service provided from local authority on personal solid waste management behaviour of Colombo district residents?

## VII. CONCEPTUAL FRAMEWORK

Researcher has examined relationships between independent variables and dependent variables to develop the conceptual framework. Personal norms, attitudes and skills, social norms and attitudes, situational factors (inconveniences) and satisfaction with service provided from local authority are identified as independent variables and personal solid waste management behaviour (PSWMB) is considered as dependent variable.

### A. *Relationship between Personal norms, attitudes and skills and personal solid waste management behaviour*

Janmaimool, (2017) has signposted that there is a significant relationship between the personal norms and the waste management behavior. Mehmetoglu, (2010) has postulated that individuals' feelings of a moral compulsion to preserve the environment were positively associated to their pro-environment behavior. Under the current study author has leveraged this association of personal norms towards personal solid waste management behaviour. Meantime, Frank & Stephen, (2011) the relationship between personal norms, attitudes and skills was established between personal solid waste management behaviour.

### B. *Relationship between Social norms, attitudes and personal solid waste management behaviour*

Janmaimool, (2017) has signposted that there is a positive relationship between social norms and solid waste management behaviour at work place. In contrast, the same

study has established a relatively strong positive relationship between social norms and organizational norms which exert a significant impact on personal solid waste management behaviour. In contrast, Frank & Stephen, (2011) has identified social norms and attitudes as a predictor of recycling behaviour but not deployed in constructing the regression model. Therefore, researcher supposes to examine relationship between social norms and attitudes and (PSWMB).

### C. *Relationship between situational factors (inconveniences) and personal solid waste management behaviour*

Kline, (1988) has proposed that individuals will not engage in an activity if that is perceived as stubborn, troublesome and unsuccessful. Meantime Frank & Stephen, (2011) has presented that there is a negative relationship between situational factors and (PSWMB).

### D. *Relationship between satisfactions with service provided from local authority and personal solid waste management behaviour*

Elgaaied, (2012) has claimed that there is a significant positive relationship between recycling behaviour and perceived facilitating conditions. Besides, Frank & Stephen, (2011) has suggested about the positive relationship between satisfaction with service provided from local authority and personal solid waste management behaviour. In current study researcher need to examine the claim of Frank & Stephen, (2011) in relation to Colombo district residents for (PSWMB).

## VIII. HYPOTHESES

Following hypotheses are proposed by researcher for above established relationships.

H<sub>10</sub>: Personal norms, attitudes and skills have a positive impact on personal solid waste management behaviour of Colombo district residents

H<sub>20</sub>: Social norms and attitudes have a positive impact on personal solid waste management behaviour of Colombo district residents

H<sub>30</sub>: Situational factors (inconveniences) have a negative impact on personal solid waste management behaviour of Colombo district residents

H<sub>40</sub>: Service provided from local authority has a negative impact on personal solid waste management behaviour of Colombo district residents

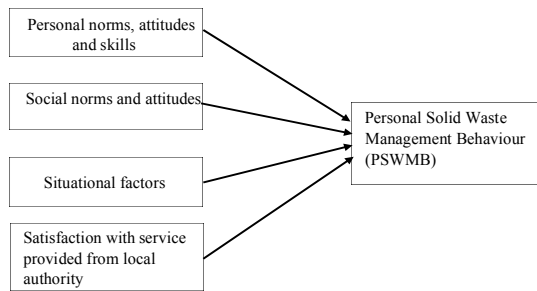


Figure 5: Conceptualization of PSWMB [Source: Author]

## IX. METHODOLOGY

Sekaran & Bougie, (2013) have presented hypothetic-deductive method as a scientific method for researches which follow a systematic approach. It involves with seven identical steps including identifying a broad problem area, defining problem statement, developing hypotheses, determining measures, collecting data, analyzing data and interpreting data. According to Malhotra & Dash, (2010), the current study is identified as a descriptive, single cross sectional since it is focusing on relationship between four independent variables and a one dependent variable with a selected representative sample through a structured questionnaire. Therefore, the best suitable research design is descriptive, single cross sectional with hypothetic deductive method. The same research design has deployed in previous studies also (Frank & Stephen, 2011; Janmaimool, 2017).

## X. SAMPLING METHOD

Malhotra & Dash, (2010) have introduced five steps to craft a sample for a research. It includes definition of target population, determine sample frame, selection of sampling technique, determining sample size and executing sampling process.

For study, Researcher has assumed all residents in Colombo district according to the Electoral register as the population. In contrast due to the legal restrictions to access this source document, researcher has considered about residential telephone directory of Colombo district. Researcher has concerned both males and females who are above 20 years old since it requires literacy ability to respond a questionnaire. Researcher has used simple random sampling for study since previous studies also followed the same sampling technique (Frank & Stephen, 2011; Janmaimool, 2017). Sekaran & Bougie, (2013) has suggested that, if population is more than 10,000 the sample should be between 200 to 1000. Therefore, sample size of study is limited to 250 since time is limited.

## XI. DATA COLLECTION

### A. Primary data

A structured questionnaire consists with demographic data, scale of personal solid waste management behaviour will be

administered to the sample respondents of study through a google form and a manually administered questionnaire.

### B. Secondary data

Secondary data of study has gathered from early academic works on similar type of studies published in Emerald insight, Research gate, Willey, Jstore and few websites, newspaper articles were referred to capture statistics and current information for background of study.

### Data analysis

IBM SPSS statistic 20.0 package will be used in current study to analyze demographic data, to test validity and reliability of data, to establish regression model and to test hypotheses suggested by the researcher.

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# Identify the Efficiency Enhancement Factors in Inventory Management, Reference to Pharmaceutical industry in Sri Lanka- Conceptual Paper

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**Abstract**— Inventory is defined as the goods which are stored by an organization for the purpose of manufacturing or sale. It can be in various forms including raw material, components, work in progress or finished goods. Basically Inventory consists with one of the important items of current assets of an organization, which permits smooth process of operation, production and sales process. As a result of that, proper management over the inventory will be essential; since inventory management is mainly concerned with maintaining optimum investment over inventory and effective control over the system so as to reduce the total inventory cost which adds high cost value to the total logistics cost. This conceptual paper is focusing on to identify factors, which can impact on enhancement of efficiency of inventory management in pharmaceutical industry in Sri Lanka.

**Keywords**— *inventory, inventory management, efficiency*

## I. INTRODUCTION

Today's dynamic business context has rapidly grown and has become more competitive as ever in nature. While creating the competitive edges relent to industry, which operate in, companies required to focus on its resources to what are they best. Supply chain management has directed organizations to re-think their entire operation and re-structure it, firms must look at the big picture of the whole process, and figuring out which process can be reduce, eliminate, create and raise. Therefore better supply chain performance plays a vital role in present context and most of the companies have realized the importance of having efficient supply chain to increase their performance. When it comes to better supply chain, inventory management is an extremely important function and inventory constitutes a major component of working capital.

Basically Logistics defines as the “process of planning, implementing and controlling the efficient, cost effective flow and storage of raw materials, in process inventory, finished goods and related information flow from point of origin to point of consumption for the purpose of conforming to customer requirements” (Cooper & Lambert, 1996). Inventory management is concerned as the significant factor in logistics management. Reducing inventory investment in the supply chain, enhance the customer service, building competitive advantage for the supply chain can be emphasized as the overall objectives of the Supply Chain Management. (Cooper, 1993). So that it can be concluded as inventory management is an extremely important function when concern about the supply chain of a company.

With reference to the Inventory Management practices in Pharmaceutical industry Sri Lanka, There is inefficiency in inventory Management. Preliminary discussion that

conducted with the industry experts relevant to the pharmaceutical industry Sri Lanka. Around 50% of purchased medicine stocks will be disposed for each batch procured in almost every pharmaceutical organization, which operate in Sri Lanka. As per the preliminary discussion, Mainly pharmaceutical companies should focus on proper demand forecasting method and the proper tracking records as well for an efficient inventory Management system. Therefore this study is focus on to suggest factors for enhancement of efficiency in inventory management in pharmaceutical industry Sri Lanka..

## II. LITERATURE REVIEW

### A. Inventory

Inventory is the total amount of goods or materials contained in a store or factory at any given time. There are four types of inventories can be identified. Those are raw material inventory (materials that are usually purchased but have yet to enter the manufacturing process), work in progress inventory (products or components that are no longer raw material, but have to yet become finished products), Finished good inventory (an end item ready to be sold, but still on the company's book). (Heizer & Petersen, 2005).

Since inventory is necessary in the system, some supply chain members may keep a disproportionate amount of inventory (Cooper & Lambert, 1996). Any Supply chain conduct inventory with variety of intentions. For instances inventories can be held to improve production scheduling, to smoothen production in the face of fluctuating sales, to minimize stock out costs, to speculate on or hedge against price movements, to reduce purchasing costs by buying in quantity, to shorten delivery lags, and so on (Shafi, 2014).

### B. Inventory Management

Inventory management is a science primarily about specifying the shape and percentage of stocked goods. Inventory management also concerns fine lines between the replenishment lead time, carrying costs, asset management, inventory forecasting, valuation of inventory, future inventory price forecasting, physical inventory, inventory visibility, available space for inventory, quality management, replenishment, returns, defective goods and demand forecasting (Shafi, 2014).” Inventory systems are developed with the aim of reducing costs associated with inventory management. Inventory management systems are however described as complex systems to develop (Jones, 1985). More and more institutions including small-scale enterprises are increasingly adopting inventory management systems

with the aim of achieving competitive advantage and enhancing their performance (Nyabwanga, 2012).

Inventory constitutes a major component of working capital, hence the success and failure of a business depends upon its inventory management performance. The basic objective of inventory management is to optimize the size of inventory in a firm so that smooth performance of production and sales function may be possible at minimum cost (Shafi, 2014).

Inventory Management plays a decisive role in the enhancement of efficiency and competitiveness of business enterprises (SWALEH, et al., 2014). Managing inventory in an effective manner has a positive impact on the business since it allows business to meet or exceed customers' expectations of product availability with the amount of each item that will maximize their company's net profit or minimize its total inventory investment (Nyakeri & Ochiri, 2014).

"Possessing high amount of inventory for long periods of time is not usually good for a business because of inventory storage, obsolescence, and expiry, spoilage costs. Effective inventory management entails holding an appropriate amount of inventory. Too much inventory consumes physical space, creates a financial burden, and increases the possibility of damage, spoilage and loss (SWALEH, et al., 2014). On the other hand, the possessing of too little inventory isn't good either, because the business can face the risk of losing out on potential sales and potential market share as well. Undoubtedly more business failures are caused by an overstocked or under stocked condition than any other factor.

### *C. Efficiency in Inventory Management*

Epa (1996) reveals that proper controlling of raw materials, intermediate products, final products, and wastes is a significant way to increase the efficiency of inventory management. Inventory control creates high impact on the efficiency in inventory management. Improving inventory control ranges from simple modifications in the procedure of ordering materials to just-in-time (JIT) manufacturing techniques. Improved inventory control can reduce material expenses and reduce the waste that is generated and its associated costs and ultimately contributes to enhancing the efficiency in inventory management (Panday, 2004)

The improved inventory control implies a faster adjustment of inventories to changes in sales as well as a decline in the average ratio of inventories to sales. There are other goods-stocking sectors to consider besides manufacturing. In contrary to widely held opinion, improved inventory control can result in increased, rather than reduced, volatility in inventory investment (Shafi, 2014).

Technological advancement contributes to enhance the efficiency in inventory and warehouse management. Especially in Automation of key processes enables organizations to become more efficient while minimizing errors and freeing up resources in inventory management to perform value added activities (Deakins, 2006). Investment in technology is desirable to more efficiently and effectively manage the supply chain.

Integration has allowed within the chain of supply align production with forecasted sales volumes, while simultaneously reducing inventory levels and increasing customer service levels. Thus cause to enhance the efficiency in inventory management (Deakins, 2006). This is attributed to the fact that inventory management spans

through most of the departments within an institution each having its own heterogeneous functions. Moreover, institutions should integrate their inventory management systems with those of their suppliers (SWALEH, et al., 2014). Through that, the efficiency of the supply chain process will be significantly enhanced.

Institutions throughout the world have adopted inventory management systems into their operations (SWALEH, et al., 2014). The changes in the corporate environment would necessitate and result in changes of inventory management. In particular, institutions will seek for systems that will enable them manage their supply chains more effectively and efficiently (Jones, 1985). Currently the inventory management practices have changed significantly. Developments in IT have made most of the institutional processes within organizations more efficient (Gunasekaran, 2001).

The use of statistical and accounting measures under the accounting material control to maintain knowledge of the quantities of Stores present in each of a facility is necessary for efficient inventory management procedure. Basically it includes the use of physical inventories and materials balances to verify the presence of materials or to detect the loss of material after it occurs, in particular, through theft by one or more insiders. It is concerned with the safe guarding the enterprises property in form of materials by properly recording the receipts, consumption of materials and the balance in storage (Panday, 2004).

Timely inspections also essential to enhance the accuracy of stock levels in the inventory verify the accuracy of stock records that support the value shown in the balance sheet by physical verification of the item. This may even disclose frauds, theft or loss and any weakness in the system of custody and control of stock. And also that the size and number of surpluses and deficiencies revealed by stock taking is a good criteria to assess the efficiency of store keeping methods and material control procedures (Nyakeri & Ochiri, 2014).

Qualified staff that is competent and skilled will help the organization to achieve its goals and objectives by being efficient and effective when carrying out their various functions including the inventory management also. For an organization to succeed, qualification is therefore a pre-requisite and must be matched with job requirement, hence the need to hire and develop ambitious personnel. If staff involved in stock control is not qualified and competent, then there will be ineffectiveness in inventory control (Ng'ang'a, 2013).

According to (Kaärkkainen, 2003), RFID can help companies provide operational efficiencies and improve stock level transparency in short shelf-life product distribution in a grocery supply chain. (Alvarez, n.d.) Shows that by 2006-2007, enterprises will deploy RFID tagged assets, and by 2008-2009, enterprises will tag more than 70 percent of their assets thereby reducing operating costs by 1-3 percent through reduction of lost assets, improved tracking of asset maintenance, and protection of assets from theft, fraud, or injury.

The emerging concept of Supply Chain Management follows a logical progression. In order to minimize inventory in the supply chain, information systems must be able to track and communicate production and customer requirements at different levels in the chain. Marketing and customer services must know product availability. Thus, all functions or business processes need some level of upstream

and/or down stream coordination and visibility (Cooper & Lambert, 1996). This inaccuracy of inventory records can lead to the reduction of profit of the company (Chuang and Oliva, 2015) and may be too late to be prevented.

Developing supply chain relationships through new technology usage such vendor managed inventory can be beneficial at all levels of the industry life-cycle to improve new-product speed to market, to minimize excess inventory for products in decline, and to reduce supply chain costs for products in the shakeout, mature and declining stages. The only use of VMI or EDI will not be worked unless supported by business process re-engineering and supply chain relationships (Deakins, 2006).

The traditional methods of modeling and forecasting are not sufficient; implementation of an advanced forecasting techniques or Models such as ERP, MRP and EOQ showed much greater efficiency in inventory management (Nyakeri & Ochiri, 2014). ERP implementation enhance accuracy in inventory management, provides speed in inventory management, reduce the cost managing inventory, helps with proper controls in inventory management and finally provides efficiency in inventory management (Nyakeri & Ochiri, 2014).

There are many examples of internal controls that can be implemented by the company in managing their inventory. These include maintaining catalogue or documents for every item, using bar code and radio frequency identification tags to track stock movement (Talavera et al, 2015), installing enterprise resource planning technology to immediately alert managers of potentially cost overruns that possibly causes by the inventory, proper numbering of every items, maintaining up to date inventory records, periodic audit of materials and performing cycle count activity at regular periods. This research will focus on the cycle count activity (Suhaimi, N.S.A., Nawawi, A. and Salin, A.S.A.P., 2016).

Enterprise resource planning (ERP) can be employed to integrate all systems in a company, including inventory management. It can identify any potential of cost overruns and immediately alert the managers (Suhaimi, N.S.A., Nawawi, A. and Salin, A.S.A.P., 2016). However, this technology is typically expensive and complex.

### III. METHODOLOGY

This research is going to address on following objective.

1. Identify factors that affect to the efficiency of inventory management in Pharmaceutical industry in Sri Lanka.

With reference to the literature review, inventory management has become a key factor in most of the businesses. When it comes to pharmaceutical sector, In Sri Lankan context, most of the companies which belongs to the pharmaceutical sector are not much good at managing their inventory properly. As per the preliminary discussion, it could be identified that, there is a huge wastage over the inventory management in their companies.

Therefore this research is mainly focus on how to manage the inventory properly when it comes to local pharmaceutical sector as well as the international pharmaceutical sector. Mainly answering for this question will be the essence of the research. Literature was reviewed with relevant to the above objective to finalize the factors which impact on the efficiency enhancement in inventory management in pharmaceutical industry Sri Lanka.

### IV. SUMMARY OF RESEARCH FINDINGS AND CONCLUSION

This research is about “Enhancing the efficiency of inventory management in pharmaceutical industry”. This study was conducted using 32 researches relevant to the inventory management.

The summary of the Literature analysis is shown in the table below.

#### 1. LITERATURE SUMMARY

Year	Author	Research Topic	Factors				
			RFID Implementation	ERP / computer based software system	Cycle counting and periodic review system	Standard operating procedures	Proper inventory Proper Demand forecasting
2006	B.S. Vijayaraman and Barbara A. Osyck	An empirical study of RFID implementation in the warehousing industry	1				
2004	Jabjiniak, B. and Gilbert, G	RFID warrants a strategic approach	1				
2003	Karikaäinen, M.	Increasing efficiency in the supply chain for short shelf life goods using RFID tagging.	1				
2004	Lockett, D.	The supply chain	1				
2018	Amgad Badawi, Essam Shehab, Jing Zeng, Mostafa Mohamad	ERP benefits capability framework: orchestration theory perspective		1			
2002	Shang, S. and Seddon, P.B.	Assessing and managing the benefits of enterprise systems: the business manager's perspective		1			
2013	Schryen, G.	Revisiting IS business value research: what we already know, what we still need to know, and how we can get there		1			
2004	Melville, N., Kraemer, K. and Gurbaxani, V.	Review: information technology and organizational performance: an integrative model of it business value		1			
2013	Siali, F., Yao, L. and Kie, C.J.	Inventory management and logistics cost reduction, Malaysia herbal medicine company		1			
2018	Norazira Abd Karim, Anuar Nawawi, Ahmad Saiful Azlin Puteh Salin,	Inventory control weaknesses – a case study of lubricant manufacturing company			1	1	

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Year	Author	Research Topic	Factors					
			RFID Implementation	ERP / computer based software system	Cycle counting and periodic review system	Standard operating procedures	Proper inventory	Proper Demand forecasting
2009	Asare, T.	Internal auditing in the public sector: promoting good governance and performance improvement			1			
2014	Feng, M., Li, C., McVay, S.E. and Skaife, H.A	Does ineffective internal control over financial reporting affect a firm's operations			1			
2015	Talavera, H.E., Banks, J., Smith, N.R. and Cárdenas-Barron, L.E.	Enhancing the management of shared inventory in the steel industry using RFID: an alternative to Bar codes	1	1		1	1	
2016	Suhaimi, N.S.A., Nawawi, A. and Salin, A.S.A.P.	Impact of enterprise resource planning on management control system and accountant's role – a case study		1			1	
2018	Norazira Abd Karim, Anuar Nawawi, Ahmad Saiful Azlin Puteh Salin	Inventory management effectiveness of a manufacturing company- Malaysian evidence			1			
2016	Suhaimi, N.S.A., Nawawi, A. and Salin, A.S.A.P.	Impact of enterprise resource planning on management control system and accountant's role – a case study		1				
2015	Chuang, H.H.C. and Oliva, R.	Inventory record inaccuracy: causes and labor effects					1	
2006	Samad, R.A., Wahab, R.A. and Christabel, S.	Financial Management for Beginners			1			
2005	Samad, R.A., Wahab, R.A. and Christabel, S.	Expressing inventory control policy in the turnover curve			1			
2006	Sezen, B.	Changes in performance under various lengths of review periods in a periodic review inventory control system with lost sales			1			
1999	Evers, P.T.	Filling customer orders from multiple locations: a comparison of				1		

Year	Author	Research Topic	Factors					
			RFID Implementation	ERP / computer based software system	Cycle counting and periodic review system	Standard operating procedures	Proper inventory	Proper Demand forecasting
		pooling methods						
2014	SWALEH, Anisa, Lucy, Susan	Factors Affecting Effective Implementation of Inventory Management Systems in the Public Sector		1		1		
2013	Ng'ang'a, Kariuki James	An Assessment of the Factors Influencing Effectiveness of Inventory Control		1	1	1		1
2014	Nyakeri, Abel Bogonko; Ochiri, Mr. George	Factors Affecting Effective Inventory Management In Healthcare Facilities Service Delivery In Kenya		1			1	1
1996	Cooper, Martha C.; Lambert, Douglas M.	Supply Chain Management: More Than a New Name for Logistics						1
2006	Deakins, Kim Dorling John Scott Eric	Determinants of successful vendor managed inventory relationships in oligopoly industries	1	1				
2015	Talavera et al	Enhancing the management of shared inventory in the steel industry using RFID: an alternative to Bar codes	1	1			1	
2010	Timo Ala - Risku, Jari Collin, Jan Holmström, Juha - Pekka Vuorinen,	Site inventory tracking in the project supply chain		1			1	1
2000	Christoph er, M	The agile supply chain – competing in volatile markets		1				1
2004	Lee, H.L.	The triple-a supply chain		1			1	1
2005	Kannabiran, G. and Bhaumik, S.	Corporate turnaround through effective supply chain Management	1	1				

As per that, following conceptual framework was developed based on the literature with reference to the study area.

As per the theoretical background above mentioned factors can be identified as the factors which impact on the efficiency enhancement in inventory management in pharmaceutical industry Sri Lanka. Researcher is focusing

on to develop this framework on an empirical research in future.

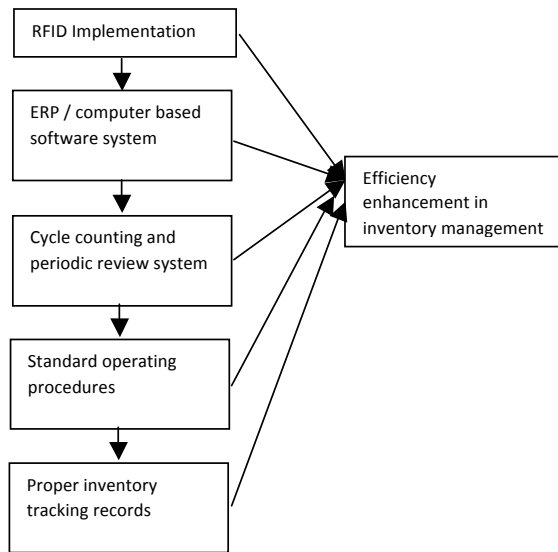


Fig. 5. Conceptual Framework.

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# Knowledge Sharing Behavior of Management Undergraduates in Sri Lankan Universities.

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**Abstract—** Mission of universities is to equip students with the necessary knowledge for their future careers. Universities focus on creating innovative techniques, which help students to learn through knowledge sharing among the students as well as from educators. An important question for universities is how to focus on socio psychological factors that affect students' knowledge sharing. Knowledge sharing is dependent on individual cognitions, which is one of the complex task forms. Theory of Planned Behavior is an ideal theory to understand why people choose to share knowledge in some contexts not in others. Present study investigates how attitudes, subjective norms, perceived behavioral control and personality of students affect their intention and behavior to share the knowledge.

**Keywords—**knowledge sharing, intention, behavior, personality

## I. INTRODUCTION

Higher education institutes have long been regarded as knowledge-intensive organizations [1]. One of the prime tasks of universities is to transfer the knowledge base to the students which enable them to thrive upon the graduation [2]. Due to the high demanding nature in the education, students tend to engage in Knowledge Sharing activities [3]. Research has provided much evidence that Knowledge Sharing in collaborative learning results in reflection and learning where all participant benefit in terms of cognitive gains and positive learning outcomes [4]. Therefore Studies on knowledge sharing among university students have been recognized as an important and interesting area of study in the academic world [5]. Focus of the present study is to explore the factors determining university students' knowledge sharing intention in Management education.

According to the Economic Policy Statement of government of Sri Lanka, issued in October 2016, Sri Lanka envisions achieving sustainable development [6]. It is stated in the economic policy statement that Sri Lanka's human capital is an essential resource in achieving the envisaged development goals and in transforming the economy into a modern manufacturing economy [6]. As highlighted, it is increasingly important for the country to be equipped with an educated workforce. Thus, in attaining the envisioned national goal it is essential that universities facilitate intellectual discourse among undergraduates. A critical element in intellectual discourse is Knowledge sharing [9].

In one hand knowledge sharing is essential to improve the learning process [9]. Higher education institutes focus on increasing student's performance by conducting knowledge sharing effectively among students [9]. On the other hand, knowledge sharing is vital, as when doing recruitments companies give much priority to the student's knowledge sharing ability. Therefore, Students in learning communities are expected to be responsible of their

education proactively by learning with both individual responsibility and communal sharing [9].

However, as per the previous studies it is evident that individuals are likely to withhold their knowledge in knowledge contribution activities [7]. Students may embrace the mentality of hoarding knowledge with competitive advantage against other students [5]. If their unwillingness to share knowledge with peers continues, it is very likely that this may become part of their personality and students may exhibit the same mindset as they continue their studies, or worst, at the workplace [5]. Therefore student's unwillingness to share knowledge is an obstacle to social knowledge construction in the context of university management education [8].

In the context of Management education many students tend to withhold their efforts in group works when they are asked to share knowledge [8]. One of their beliefs is that if shared with others in the group their knowledge would become less valuable [8]. Therefore a key challenge in both online and traditional learning is to encourage knowledge sharing through various forms.

Engaging in knowledge sharing is strongly influenced by the individual's willingness to engage in the knowledge sharing process. In [9] it is stated that simply telling the students that sharing knowledge make you learn better do not automatically lead to knowledge sharing among them. Therefore investigating willingness to share knowledge through the determinants of knowledge sharing behavior of students is vital to understand the social phenomena better in order to promote knowledge sharing for better learning process.

Many studies have investigated about the determinants of knowledge sharing behavior of individuals. However pause of attention has been given for knowledge sharing behavior among the students in online and traditional learning environments where teaching and learning is the main concern [9]. Further much attention is given for knowledge sharing behavior in organizational setting, but pause of literature available on the studies conducted in educational settings considering knowledge sharing behavior among students [9]. It is stated that future research should examine knowledge sharing of students from different theoretical perspectives as very few studies ground the studies on the theory [3]. Thus, It is emphasized that further studies required establishing clear conclusions on knowledge sharing behavior of undergraduates [3].

Due to highlighted paucity in theoretical and empirical studies the present study focus on investigating the determinants affecting knowledge sharing intention of students in Management education.

## II. LITERATURE REVIEW

### A. Knowledge and Knowledge Sharing Behavior

Knowledge sharing is considered as a social phenomenon based on interpersonal and social interactions [8]. In online and traditional learning it is a key challenge to encourage knowledge sharing through social interactions. Knowledge sharing happens when the knowledge is shared by individuals negotiated, refined within a group until it becomes common knowledge to the group [10]. Knowledge sharing enables individuals to re adapt and reconstruct knowledge by opening up multiple perspectives to challenge one's understanding while taking into peer's perspectives. Individuals co construct the knowledge by reflecting newly shared knowledge, justifying, defining, revaluating thoughts and externalizing [11].

Extant knowledge management literature have investigated the factors affecting knowledge sharing intention [12, 13, 14, 15, 16]. In [15] it was found that personality traits have a significant influence on knowledge sharing. Furthermore, prior studies usually explain knowledge contribution behaviors from various theoretical perspectives and Knowledge Sharing is important because of its role in student's learning outcomes.

Attitude toward the behavior is the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior Ajzen [17]. Students are likely to have intention to share knowledge if their common feelings towards the sharing behaviours are positive. Thus, it is assumed that there is a positive relationship between attitude of student's and knowledge sharing behavior.

H1: Attitude towards knowledge sharing is positively related to the intention to share knowledge

### B. Subjective Norms and Knowledge Sharing Behavior

Subjective norm is the perceived social pressure to perform or not to perform the behavior. According to [17] Social pressure may be from the working groups, peer groups or from colleagues. In universities, students may have their groups. If a university student feels that his friends expect him to share his knowledge with them, and if he would like to enact it, then he has the intention to share his knowledge. Therefore it can be predicted that subjective norms will positively related to the intention to share knowledge.

H2: Subjective norms positively relate to the intention to share knowledge

### C. Perceived Behavioral Control and Knowledge Sharing Behavior

Perceived behavioral control is the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles [17]. In a university if the students perceive more barriers and challenges to share knowledge they will be less likely to share knowledge. Thus, it is assumed,

H3: Perceived behavioral control is negatively related to intention to share knowledge

On the other hand, perceived behavioral control may directly relate with the knowledge sharing behavior.

According to the theory of planned behavior, perceived behavioral control, together with behavioral intention, can be used directly to predict behavioral achievement. Thus, it is assumed,

H4: Perceived behavioral control negatively related to knowledge sharing behavior

### D. Intention and Knowledge Sharing Behavior

Intention is an indicator used to capture the factors that influence a desired behaviour [17] In this case, a behavioural intention measure will predict the knowledge sharing behaviours. Thus, it is assumed,

H5: The intention to share knowledge is positively related to knowledge sharing behavior.

### E. Personality and Knowledge Sharing Behavior

Big Five Personality traits are extraversion, agreeableness, openness to experience, neuroticism and conscientiousness.[18]

Agreeableness personalities are fundamentally altruistic, sympathetic to others and eager to help others and believe others will help in return [19]. Since knowledge sharing is a particular form of individual helpfulness, cooperation and collaboration, and entails "getting along with others" within interpersonal relationships with university course-mate and friends, individual high in agreeableness are more likely to share knowledge.

It is expected that highly conscientious people better perform in organizations and focus on tasks. They engage in activities which are beyond their responsibilities and expected to be more willing to share knowledge [15]. In the university environment, conscientious students tend to engage in more knowledge sharing activities such as sharing information about hobby, movie and music reviews published in the library website.

Individuals high in extraversion have the inclination to be sociable [20]. Extroverts are enthusiastic, energetic and optimistic. Studies have suggested that extroverts are positively affective, and therefore are likely to have positive emotions and contribute to greater team satisfaction [21]. When completion of group assignment depends on team work university students who are extraverted tend to share more knowledge with team-mates to accomplish group assignment.

Neuroticism contrasts emotional stability with different negative moods such as anxiety, sadness and nervous tension [22]. Low anxiety levels and high self-confidence characteristics of emotional stability make it easier for such individuals to engage in knowledge sharing behavior[22]. Thus likely that students who score high in neuroticism would interact and share information with others.

Openness to experience indicates a person as being imaginative, curious, artistic and original [18]. Thus students who demonstrate higher levels of openness, would be more willing to express their opinion and share their knowledge with others in the university.

Accordingly it is assumed that,

H5: Personality positively relates to knowledge sharing behavior



### III. RESEARCH METHODOLOGY

The study adopted the quantitative survey-based technique to test the hypotheses. The questionnaire was developed based on widely used instruments. The items for attitude towards knowledge sharing, subjective norm, intention to share knowledge, perceived behavioral control and knowledge sharing behaviour constructs were adapted from [17]. The response format is seven-point Likert type scale.

The five dimensions of BFP [(1) extraversion; (2) agreeable; (3) conscientiousness; (4) neuroticism; and (5) openness to experience] are measured using the instrument developed by [18]. Respondents indicated how they generally feel by rating the degree of their feelings on a six-point scale.

The unit of analysis for this research is the individual, that is, the university student. The Participants sampled are students from both public and private Sri Lankan universities. Stratified random sampling method is employed in this study. The strata used in this sampling are students' who are reading for Business Management degree programmes. An online and self-administered questionnaire was distributed to students enrolled in the Business and management degrees. Sample consisted 230 students where 203 respondents responded.

### IV. DUSCUSSION

According to the conceptual framework developed in the study, there are four (04) independent variables, one mediator and a dependent variable. Attitudes towards knowledge sharing, subjective norms, perceived behavioral control and personality have been identified as independent variables whereas intention to share knowledge is the mediator which mediates the relationship of attitudes, subjective norms, perceived behavioral control and knowledge sharing behavior. Knowledge sharing behavior is the dependent variable of the study. According to the Theory of Planned Behavior [17], intention to share knowledge mediate the relationship of attitudes, subjective norms, perceived behavioral control and knowledge sharing behavior. Therefore using regression analysis in SPSS 21 authors initially checked the mediating effect of intention to share knowledge.

Since, intention to share knowledge identified as a mediator in the conceptual framework, first the regression model has been obtained with the absence of intention to share knowledge. In this model the knowledge sharing behavior has been identified as the dependent variable where attitude, subjective norms, perceived behavioral control and personality identified as independent variables.

The regression model indicates a significant positive relationship between knowledge sharing behavior and independent variables (attitude, subjective norms, perceived behavioral control and personality) where regression line is significant ( $F$  value= 760.594,  $P$  value< 0.05) and according to the coefficients of the regression shows the  $P$  values of the independent variables (attitude, subjective norms,

perceived behavioral control and personality) are less than 0.05 and the  $R$  square of the model is 89.7%. The variation of knowledge sharing behavior is explained by the dependent variables (attitude, subjective norms, perceived behavioral control and personality). In the next step, the regression model obtained with intention to share knowledge.

However, a special behavior of attitude and subjective norms can be observed in the regression analysis when the intention to share knowledge is absent attitude and subjective norms are significant to the regression model and when intention to share knowledge present in the regression attitude and subjective norms become insignificant to the model. Therefore it is clear that the relationship between knowledge sharing behavior and attitudes, subjective norms is fully mediated by intention to share knowledge. Further it is confirmed that according to [17] in The Theory of Planned Behavior, Attitudes, subjective norms and perceived behavioral control mediated by intention to share knowledge. According to the results of the analysis relationship between knowledge sharing behavior and perceived behavioral control partially mediated by intention to share knowledge where in both regression models perceived behavioral control remain significant.

The regression model after adding intention to share knowledge indicates a significant positive relationship between knowledge sharing behavior and independent variables (attitude, subjective norms, perceived behavioral control and personality) where regression line is significant ( $F$  value= 623.423,  $P$  value< 0.05) and according to the coefficients of the regression shows the  $P$  values of the independent variables (attitude, subjective norms, perceived behavioral control and personality) are less than 0.05 and the  $R$  square of the model is 90%. The variation of knowledge sharing behavior is explained by the dependent variables (attitude, subjective norms, perceived behavioral control and personality).

### V. CONCLUSION

In conclusion, the present study addressed a significant gap in the knowledge sharing literature in the educational context. In particular, the present study contributes by enlightening the understanding of factors affecting knowledge sharing intention and behavior of Management students in Sri Lankan Universities. According to the investigation it was found that there is a significant relationship between Management student's attitudes, subjective norms, perceived behavioral control, personality and students' knowledge sharing intention and behavior. Therefore in facilitating the learning process by focusing on higher level of knowledge sharing, universities must try to create an environment that can enhance the attitudes, subjective norms and perceived behavioral control of students. Further in developing educational policies to facilitate for more knowledge sharing among management students, universities and educators must be more concerned

regarding the personality of the students and its influence for their intention to share knowledge.

However, one of the limitations of the present study is the reliance on sample data collected from Sri Lanka. Since international research will contribute to greater generalisation of the model proposed, a replication of this study should be performed in other countries in other educational streams with larger sample size. Given the importance of knowledge sharing in today's society, it is hoped that the research model proposed in this study will be useful to other researchers seeking to understand the factors that influence the knowledge sharing behaviour among the students. Further Findings of the present study will contribute for the educators, instructional designers and curriculums developers to identify key factors involved in successful knowledge sharing process in designing and delivering the degree programmes. Further such understanding can be utilized to develop advisable strategies to create conducive learning environment. It is expected that the findings will contribute knowledge sharing practices among students in order to enhance their student's performance as well as for the education policy reforms of Sri Lanka.

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# Gender Based Segmentation Analysis of Suicide Rates in an Emerging Economy

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**Abstract**— Psychographic segmentation analysis is considered as a cornerstone in assessing human psychology. It's a statistical technique that has been extended in the recent past to subject areas considered as social burdens such as suicide. Suicidal tendencies based on gender based issues such as harassment, mental disorders and sexual incapacity have been the focal point of many a research psychologist. In such a context the application of statistical segmentation analysis to examine gender based suicide data of a secondary nature becomes a worthwhile proposition. Suicide is widely considered as a major social burden in Sri Lanka and it is validated by various credible benchmarks. Therefore application of segmentation methodology by segregating data from an emerging economy such as Sri Lanka at multiple variable levels to create enlightening output information becomes the core contribution of this paper. It provides deeper insights in terms of the influence of various factors towards suicide. As a secondary contribution to the existing body of knowledge social and cultural interpretations in terms of the findings are provided for clarity and completeness.

**Keywords**— *segmentation, dimension reduction, principal components, tendencies.*

## I. INTRODUCTION

Health is defined as the “state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” based on the World Health Organization (WHO) definition of 1948 as illustrated in Huber et. al. (2011). As an extension to it WHO defines mental health as a “state of well-being in which every individual realizes his or her own potential, with an ability to cope up with normal stresses of life, as well as work productively and fruitfully in order to make a contribution to his or her community”.

Deterioration in mental health leads towards mental instability. In turn mental instability at a higher degree could cause suicide. Stedman (2000) defines suicide as the act of intentionally causing one's own death. Sri Lanka is a nation blessed with abundant natural resources and a skilled work force due to a literacy rate exceeding ninety percent. Yet, the country has experienced a high suicide rate even after the conclusion of a civil war that engulfed the nation for over three decades. Psychographic segmentation of social variables was introduced by Mitchell (1978). It involves dividing your target group into segments based upon different personality traits, values, attitudes, interests, and lifestyles. Generally it is a statistical technique utilized in market research to identify various consumer groups. In this paper the methodology is extended towards the segmentation of various cohorts involved in suicide. For appropriateness and to avoid complexity the study is confined to the emerging economy of Sri Lanka that has ranked within the top tier of nations faced with the suicide burden.

Based on complete suicide frequency ranking information of the year 2015, Sri Lanka was the top nation in terms of overall number of suicides, one of 50% of the countries in the top ten suicide ranking nations with matching overall and male suicide rank indices as well as one of the 80% of countries in the top ten suicide ranking nations classified as an emerging economy. Such startling information provided a rationale and motivated the author to delve deep into the subject area and use psychographic segmentation to reveal deeper insights with respect to Sri Lanka's suicide issue in order to propose a long term remedy. The culmination of all facts linked with the social burden paved the way for a research question in the form of “if it is possible to reveal new knowledge on gender based suicide in Sri Lanka through statistical segmentation analysis”. In such a context section one of this paper deals with preliminaries. It is followed by section two on methodology. Section three of the paper provides an extensive explanation on analysis. The paper concludes with a discussion in section four.

## II. PRELIMINARIES

Preliminary information in terms of the top ten nations with the highest suicide rates in the year 2015 are provided in table 1 below.

1. SUICIDES PER 100,000 PEOPLE PER YEAR (AGE STANDARDIZED) IN THE YEAR 2015 –THE TOP 10 COUNTRIES.

Country	Both Sexes Weighted Mean	Both Sexes Overall Rank	Male	Male Rank	Female	Female Rank
Sri Lanka	34.6	1	58.8	1	13.3	9
Guyana	30.6	2	46.0	5	15.5	1
Mongolia	28.1	3	48.2	2	9.2	21
Kazakhstan	27.5	4	48.1	3	9.6	17
Cote d'Ivoire	27.2	5	38.8	8	14.4	3
Suriname	26.9	6	41.6	6	12.6	11
Equatorial Guinea	26.6	7	39.1	7	13.2	10
Lithuania	26.1	8	47.1	4	8.1	30
Angola	25.9	9	38.1	9	14.3	5
South Korea	24.1	10	36.1	10	13.4	8

Based on the information from table 1 given above it is evident that the emerging economies (middle income

countries) with a GDP per capita income between USD \$ 1,026 and USD\$ 12,475 comprising of Sri Lanka, Guyana, Mongolia, Kazakhstan, Cote d'Ivoire, Suriname, Lithuania and Angola account for 80% of the top ten countries with high suicide rates. Furthermore, countries with matching overall and male suicide rate rankings constitute 50% of the top ten nations of 2015 with the suicide burden. Therefore it is evident from the given tabular information a further segmenting of the top ranked suicide nation (Sri Lanka) is required to reveal new knowledge at a greater granular level. It will be a worthwhile proposition and will require psychographic segmentation analysis as the methodology.

### III. METHODOLOGY

Psychographic segmentation is dividing your target group based upon personality traits, values, attitudes, interests, and lifestyles. Its conceptual framework revolves around such features. In a generic sense people have different interests, attitudes, and traits. For example, some people really care about the environment, while others pay less attention. Some are very fitness and health conscious while others thrive on food. Certain people take sports seriously, while some want to have fun during the weekends. Psychographic segmentation occurs when you break your cohort under observation along these interests and attitudes such that an appropriate in-depth analysis of each segment could be done extending it from market research to a wider scope (Refer Dhalla and Mahatoo (1976)).

The results of such an analysis could be supplemented and corroborated methodologically through dimension reduction by employing statistical methodologies such as "Factor and principal component analysis (PCA)".

### IV. ANALYSIS

Psychographic segmentation analogous to divide and conquer process in computing was performed on secondary data obtained from the Department of Census and Statistics, Sri Lanka for the years 2014 - 2016. As a result of the analysis the following visual snapshots provide an interesting assessment on the suicide burden within the country.

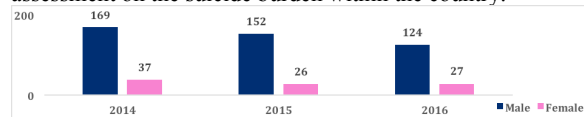


Fig. 1. Suicides in Sri Lanka due to Economic hardships.

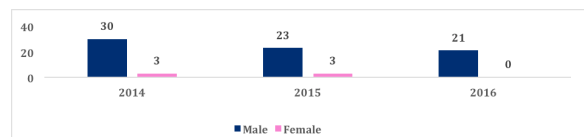


Fig. 2. Suicides in Sri Lanka due to Employment problems.

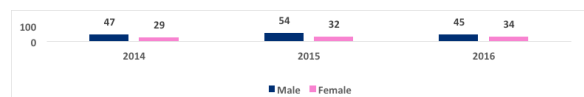


Fig. 3. Suicides in Sri Lanka due to problems with elders.

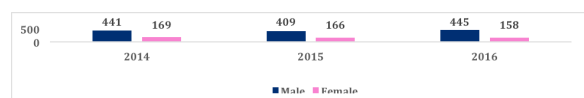


Fig. 4. Suicides in Sri Lanka due to spousal and/or family abuse.

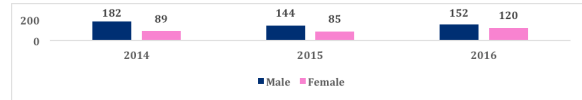


Fig. 5. Suicides in Sri Lanka due to romantic relationship issues.

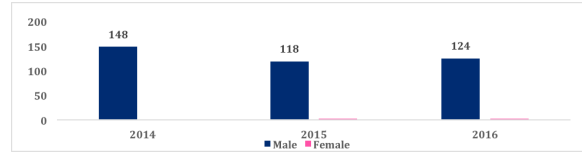


Fig. 6. Suicides in Sri Lanka due to narcotic addiction.

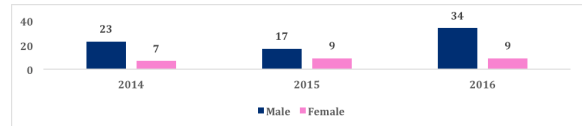


Fig. 7. Suicides in Sri Lanka due to the death of a parent or relation.

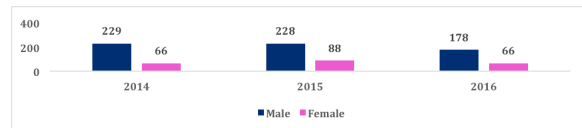


Fig. 8. Suicides in Sri Lanka due to mental disorders.

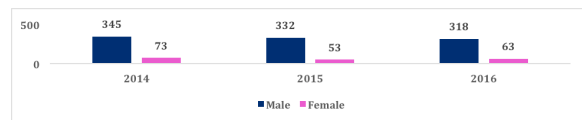


Fig. 9. Suicides in Sri Lanka due to chronic diseases and physical disabilities.

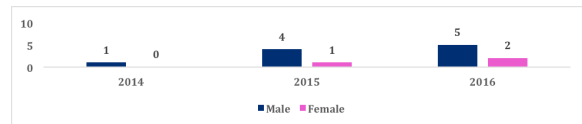


Fig. 10. Suicides in Sri Lanka due to sexual harassment / sexual incapacity and rape.

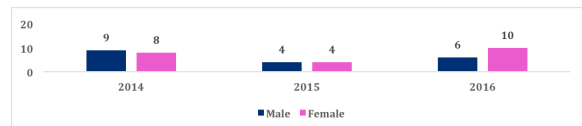


Fig. 11. Suicides in Sri Lanka due to loss of property and failing examinations.

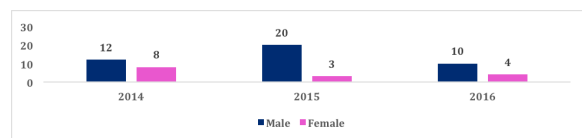


Fig. 12. Suicides in Sri Lanka due to ill-treatment by children.

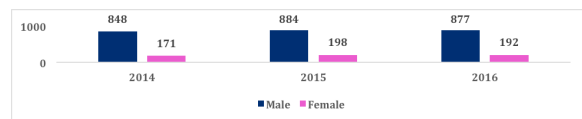


Fig. 13. Suicides in Sri Lanka due to other reasons.

Factor analysis with principal components was considered only for Male suicides, since it happened to be the predominant gender involved in the social burden. The results are provided in the following table.

COMMUNALITIES EXPLAINING COMMON / SHARED VARIANCE ASSOCIATED WITH MALE SUICIDE COMPONENTS.

Issue	Extraction
Problems with romance	0.954
Terminal sicknesses and disabilities	0.950
Spousal and family abuse	0.942
Mental disorders	0.930
Economic problems	0.921
Other problems	0.914
Drug addiction	0.868
Employment problems	0.827
Problems with elders	0.790
Ill-treatment of children	0.772
Property loss and exam failure	0.769
Sexual abuse, sexual incapacity and harassment	0.693
Death of parents and / or family members	0.623

## V. DISCUSSION

The analytical results provide a visual illustration of the segmented variables for both genders in an emerging economy (Sri Lanka). Thereafter principal components analysis of the predominant gender involved in the social burden illustrates component-wise communalities of the common or shared variance. It provides a list of issues in terms of order of extraction explaining importance and the technique could be extended to the female gender as well. Proposed remedy to address and minimize the social burden of suicide would be to invest more on economic, education and health sectors to overcome cultural stigmas linked with family units.

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# Implementation of Brain Computer Interface for Stress Management

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**Abstract**— This paper presents a stress identification system implementation, which contains an EEG Headset, a non-invasive type of brain – to – machine interfacing on which the brainwave patterns such as attention, meditation, and eye blink is acquired directly on the person's scalp. Electroencephalography (EEG) is also being examined at the time of detection where the Gamma, Beta, Alpha, Theta, and Delta brain waves are considered. The system implementation consists of two main functional modules: stress detection unit and stress visualization unit. The stress detection unit based on the analysis of EEG waves using Neurosky Mindwave EEG headset. The captured waves are then transferred to the stress visualization unit where it displays the signals in the form of a virtual fish tank, programmed to change the swimming position of a fish according to the stress levels. The development of this type of system is not only convenient but also it is portable and affordable.

**Keywords**— Brain Computer Interaction, stress, EEG

## I. INTRODUCTION

Stress has turned into a key source among populace which has made various negative effects on the society and of overall associations, and they are relied upon to end up a noteworthy wellbeing peril in the prospective decades. Nearly everybody is presented to an extensive variety of stress in both individual and work life. Some person's adapt exceptionally well to these weight, then again, some person's think that it's hard to deal with the circumstance and that is when people fall into the "stress". As indicated by International Labor Organization, idiocies caused by stress cost up to 10 percent of a nation's Gross National Production. At an individual level, word related pressure causes an adverse effect on both work life and individual life influencing the quality and prosperity. These disarranges affect the financial and social condition of the individual and society. There are many traditional and modern stress management techniques applied in order to manage stress levels. Considering the current healthcare industry and social scale there is a huge trend towards ICT supported stress management techniques. ICT Supported health intervention can be considered as a phenomenon that has grown stronger in recent years. Many web and mobile-based health communities/applications has contributed to a shift: from formal healthcare providers being the one and only source of support for most patients to a situation in which patients take an active role in each other's struggle for health and recovery. Also, for people with different lifestyle issues, the health communities have become widely used for advice and support. Through the interaction with others, patients and other people with health concerns can get help to access relevant resources, develop their ability to make personal

decisions and exercise critical thinking. They get support to develop skills and abilities along with a more positive self-image. This is also referred to as 'patient empowerment.' Thus, this research work also contribute to expand the horizons of ICT supported stress management interventions through brain computer interfacing approach.

## II. THEORETICAL BACKGROUND

### A. Brain Computer Interface (BCI)

BCI is also known as Mind Machine Interface because it is a direct communication pathway between the brain and an external device. As the power of modern computers improves understanding of our human brain. This brings closer to making some fascinating science fiction into reality. BCI could be the most important technological breakthrough in decades. BCIs are directed at assisting, augmenting or repairing human cognitive or sensory motor functions. One of the reasons that BCI works well is the way of brain usually functions. Our brain is filled with neurons, each nerve cell us connected to one another by dendrites and neurons. Every time we think, move, remember or feel something our neurons are carrying electrical signals from one to another. The simpler and less invasive method is to attach a device known as EEG to the scalp. The electrodes have the ability to read brain signals. The electrodes measure differences in voltage between neurons and the signal is then amplified and filtered. It will also be interpreted by a computer program at the end. The field of BCI research and development has primarily focused on neuro prosthetics applications that aim at restoring damaged hearing, sight and movement. Thanks to the remarkable cortical plasticity of the brain, signals from implanted prostheses can, after adaptation, be handled by the brain like natural sensor or effector channels.

### B. Eelectroencephalogram (EEG)

EEG is a test used to evaluate the electrical activity in the brain by measuring brain's voltage fluctuations as detected from scalp[1]. Brain cells communicate with each other through electrical impulses. An EEG can be used to help detect potential problems associated with this activity. It is generally is an approximation of the cumulative electrical activity of neurons. An EEG tracks and records brain wave patterns. Small flat metal discs called electrodes are attached to the scalp with wires[1]. The electrodes analyze the electrical impulses in the brain and send signals to a computer that records the results. EEG is known as the most studied non- invasive interface due to its fine temporal resolution, ease of use, portability and low testing or set up costs. The electrical impulses in an EEG recording look like

wavy lines with peaks and valleys which allow doctors or specialists to quickly assess whether there are abnormal patterns. According to the BCI used that is used to analyze results, people are required to be trained appropriate to use BCI who can work the technology.

### C. Brin waves

Basically all over the time in our waking state, our EEG will display five types of brain waves at the same time[1]. However one particular brain wave will be dominant dependent on the state of awareness that we are in. As an example if we are awake, but have really bad Attention deficit hyperactivity disorder (ADHD), we may have slower wave activity of alpha and theta than beta waves. While sleeping frequently there are combinations of the rapid eye movement (REM) [6].

**Gamma Waves:** In a complex processing tasks as well as a cognitive functioning these can be involved [6]. These waves are very important for the learning, processing of the information and memory. It is known that the 40 Hz gamma wave is very important for the binding of our senses with regard to perception and concerned in learning new materials. It has been found that people who are individually mentally challenged and have learning disabilities tend to possess lower gamma activity than average.

**Beta waves:** These waves can be defined as high frequency low amplitude brain waves [6]. These are usually observed while we are awake. They are concerned in aware thought, logical thinking and tend to have a stimulating affect. To complete work based tasks, projects easily, right amount of the beta waves helps much more. Having an excessive amount of beta could result in US experiencing excessive stress or anxiety. The higher beta frequencies square measure related to high levels of arousal. When someone take caffeine or some other stimulant, their beta activity can be naturally increased. Think of these as being in no time brain waves that the majority individuals exhibit throughout the day so as to complete aware tasks such as: important thinking, writing, reading, and socialization.

**Alpha Waves:** This frequency range avoid the gap between human's conscious thinking and sub conscious mind [6]. In other words, alpha is in the middle frequency range in the beta and theta. It will be helped to humans to be calm down when necessary and promotes feelings of deep relaxations. If human become stressed, a phenomenon called "alpha blocking" may occur. Which involves deep beta activity and very little of alpha. Basically the beta waves "block" the production of alpha, because human become too aroused.

**Theta waves:** This frequency range is mostly involved in sleep and daydreaming [6]. When feeling deep and raw emotions this waves are connected to us. People prone to bouts of depression, too much theta activities. The main benefits of the theta frequencies are, improve human's creativity, institution and make them feel more natural. It is also direct people to restorative sleep. In our working hours theta isn't produced excess. So it can be defined very helpful brain wave range.

**Delta waves:** This is slowest brain frequency in human beings. These are mostly in the babies and young children [6]. In this age human are tendency to make less delta during the sleep. They are related with deepest level of restorative and relaxation, medicinal sleep. They have additionally been found to be concerned in unconscious bodily functions like control heart beat and digestion. Adequate production of

delta waves helps humans to feel fully rejuvenated once humans tend to awaken from good night's sleep. If there's unnatural delta activity, a personal could expertise learning disabilities or have difficulties maintaining aware awareness such as brain damages.

TABLE1: BRAIN WAVE FREQUENCIES AND MENTAL CONDITIONS

Brainwave Type	Frequency range	Mental state and condition
Delta	0.1 Hz to 3 Hz	Deep, dreamless sleep, unconscious
Theta	4 Hz to 7 Hz	Creative, recall, dream, Fantasy, Imaginary
Alpha	8 Hz to 12 Hz	Relaxed, conscious
Low Beta	12 Hz to 15 Hz	Formerly SMR, relax yet
Midrange Beta	16 Hz to 20 Hz	Linking aware of self
High beta	21 Hz to 20 Hz	Alertness, agitation

### D. Neurosky Mindwave EEG headset

The brainwaves can be observed with an EEG (electroencephalograph) headset. This allows researchers to identify brainwaves patterns. During this project researcher used Neurosky Mindwave (MW003) headset as EEG headset. In Neurosky EEG headset product, basically there have two types of headset called MindWave (MW001) and MindWave mobile (MW003). Both headsets compatible with developer tools properly. But MindWave (MW001) headset is communicate via RF (Radio Frequency) and MindWave mobile (MW003) communicate via Bluetooth. When considering EEG headset, Neurosky Mindwave (MW003) EEG headset easy to calibrate and communicate.

### E. eSense

eSense™ is a NeuroSky's proprietary algorithm for characterizing mental states. To calculate eSense, the NeuroSky thinkGear technology amplifies the raw brainwave signal and removes the ambient noise and muscle movement. the eSense algorithm is then applied to the remaining signal, resulting in the interpreted eSense meter values. The eSense meters are a way to show how effectively the user is engaging Attention (similar to concentration) or Meditation (similar to relaxation). For each different type of eSense (i.e. Attention, Meditation), the meter value is reported on a relative eSense scale of 1 to 100. On this scale, a value between 40 to 60 range is considered "neutral" and is similar in notion to "baselines" that are established in conventional brainwave measurement techniques.

**ATTENTION eSense:** the eSense Attention meter indicates the intensity of a user's level of mental "focus" or "attention", such as that which occurs during intense concentration and directed (but stable) mental activity. Its value ranges from 0 to 100. Distractions, wandering thoughts, lack of focus, or anxiety may lower the Attention meter level[2].

**MEDITATION eSense:** the eSense Meditation meter indicates the level of a user's mental "calmness" or "relaxation". Its value ranges from 0 to 100. Note that Meditation is a measure of a person's mental states, not physical levels, so simply relaxing all the muscles of the body may not immediately result in a heightened Meditation level. However, for most people in most normal circumstances, relaxing the body often helps the mind to relax as well. Meditation is related to reduced activity by the active mental processes in the brain [2].

### F. ThinkGear Packets

ThinkGear components deliver their digital data as an asynchronous serial stream of bytes [3]. The serial stream must be parsed and interpreted as thinkGear Packets in order to properly extract and interpret the thinkGear Data Values. Each Packet begins with its Header, followed by its Data Payload, and ends with the Payload's Checksum Byte.

## III. METHODOLOGY

The system implementation consists of two main functional modules: stress detection unit and stress visualization unit. The stress detection unit based on the analysis of EEG waves using Neurosky Mindwave EEG headset [4]. The captured waves are then transferred to the stress visualization unit where it displays the signals in the form of a virtual fish tank, programmed to change the swimming position of a fish according to the stress levels.

### A. Data capturing Unit

This is the main window of bio feedback desktop application. Basically this form consists with main functionality of the system. These are as follows,

- Connect headset: Connect Neurosky EEG headset with desktop application.
- Disconnect headset: Disconnect Neurosky EEG headset from desktop application.
- Record EEG returns values: Use to record EEG headset returns values to the text file. When accessing EEG headset for the particular user. Application provide functionality to record their alpha, beta, gamma, meditation and attention values.
- Stop record EEG: helps users to stop recording, while there recording EEG values.
- Enable Blink: Enable blink detection using EEG headset.
- Disable Blink: This function helps to disable blink detection using EEG headset.
- Select Com port: User can assign particular port to connect headset, by default it is setup to the COM port 4.
- Select Baud rate: User can assign particular baud rate when the connect headset with desktop, by default it is setup to the 56000 baud rate.

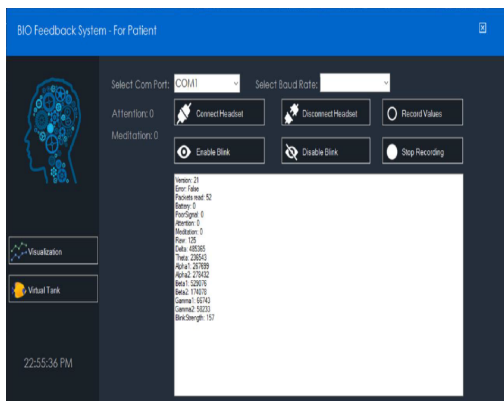


Fig. 1. Data capturing unit main window

### B. Visualization Unit: Chart Form

Basically this form consists of chart representation where the EEG returned attention and meditation values are used to generate chart X and Y axis (attention and meditation axis). Using these two values program will calculate the stress level, productivity level, engagement level of the brain. Then it will display on the visualization form. The window primarily consists of 3 buttons and 3 labels. One is used for display relax level of the user, 2nd one is used for display engagement level of the user and last one is used to display the productivity level of the brain in particular user.

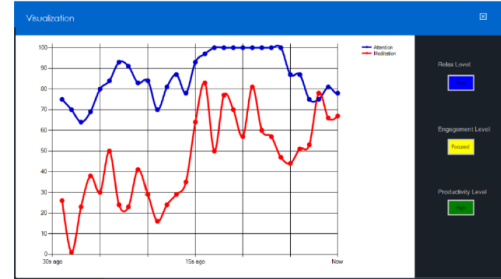


Fig. 2. Data Visualization Unit: Chart Form

### C. Visualization Unit: Virtual Tank Form

Virtual tank form used to display humans stress level, productivity level, engagement level, meditation level and attention level in form of a fish tank. Which means, this especially designed virtual fish tank (relaxation scenery) is programmed to identify different levels of stress according to the swimming position of a certain fish. They are all designed in different color codes in order to minimize confusion. The red colored fish usually swims at top level of the tank if your stress levels increased. If his or her stress levels are low, the yellow colored fish tends to swim at the bottom of the tank. Also, if your stress levels are not too high or low, the green colored fish is likely to swim in the middle of the tank. The other reason for using a virtual fish tank for the experiment is that as we are all aware fish swimming is widely used in the health sector as a scenery for cardiac patients and also for ordinary people like ourselves. It is a well-known and evidence based mind focused method of reducing anxiety and stress in people.

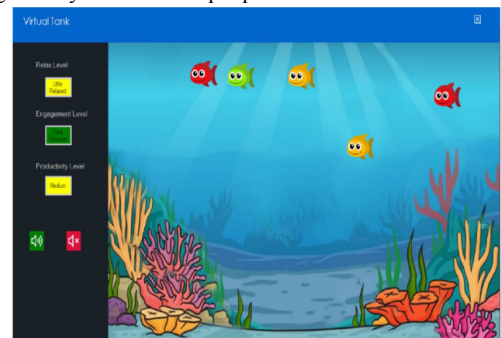


Fig. 3. Data Visualization Unit: Virtual Fish Tank

## IV. DISCUSSION

We are currently living a world where our lives are busier working or with other commitments you have in life. If you think about a work place such as garment factory in the clothing industry, we often know employees are working with strict time scales for certain orders or productions to be



completed. You may find their stress levels as high. Stress related psychological conditions can possibly cause employees to go on long term sick leave and therefore efficiency levels of the company can be reduced. In such working environments if you were to perform this experiment on randomly selected employees you'll be able to figure out employees stress levels thereby implement suitable stress management strategy minimize their stress levels at workplace. Use of biofeedback technology is widely spread approach of health care providers which are often performed by psychiatrists, psychologists and other physicians. Considering the experimental outcome biofeedback can be considered as an excellent therapy that is delivered to patients with the use BCI technology. It may appeal in situations where all other treatments have been ineffective for certain health conditions or where patients are not able to take oral medications. The fascinating about biofeedback is that it teaches you how to keep their own natural responses in stressful situations in life. That may makes you give more control over yourself in relation to handling or face situations in the way you want to be.

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# Oil Demand In Sri Lanka- An Econometric Approach

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**Abstract**— This study examines the effect of economic variables, Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Population and Oil Price on oil consumption in Sri Lanka using an Error Correction Model. Yearly data of oil consumption, Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Sri Lankan population and crude oil price during the period 1988 – 2013 were used in the analysis. All the data have been obtained by the online data sources of World Bank and United States energy information administration. This research involves estimating the elasticity of Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Sri Lankan population and crude oil price on crude oil consumption in Sri Lanka.

Unit root test confirmed that series are not stationary in its levels but they are stationary in first difference. Therefore the study uses the Engle-Granger cointegration method to create a dynamic short run model. Also Chow - break point test was used to test the significance of a structural break down in the data set and the dummy variable was significant in allowing for the structural change.

The Vector Error Correction (VEC) model finds that Gross Domestic Product (GDP), Foreign Direct Investment (FDI), population and oil price are determinants of the oil demand. It shows that in the long run only FDI increases the overall oil demand while GDP and population increase the oil demand in the short run.

By using the selected model, oil demand was forecasted and the Mean Absolute Percentage Error (MAPE) of the fitted model was found less than 5 percent. Therefore the fitted model is recommended as the suitable model to forecast oil demand. As the crude oil storage is a common problem in Sri Lanka, forecasting oil demand can be used to find the solutions for the challenges in the petroleum sector.

**Keywords**— Petroleum Sector, Demand, Sri Lanka, Crude oil

## I. INTRODUCTION

Crude oil is considered as an unrefined oil product composed of organic compound, which consists of different organic materials. Crude oil is used to refine usable products like hydrocarbon, solvents, gasoline, kerosene, diesel and various kinds of petrochemicals. It is an unrenewable resource, which implies that it cannot be replaced naturally at the speed of consumption. Hence it is considered as a limited resource.

Global crude oil demand is around 90 million barrels per day (Mbd), from that 50% is consumed by the countries who are members of Organization for Economic Cooperation and Development (OECD) [16]. Sri Lanka's crude oil consumption is very small compared with the world demand. Sri Lanka has been an importer of crude oil for a long time

and the country spends 24% of the import price on it. The Ceylon Petroleum Corporation (CPC) has been a monopoly supplier of fossil oil to the native market. However, Lanka Indian Oil Corporation (LIOC) was added to the market to form a duopoly within the fossil oil product distribution in 2003.

Sri Lanka is importing refined products since many years for domestic consumption. Hence the demand of the petroleum products are increasing in both volume and value terms. CPC was ready to meet the overall fossil oil product demand of the country through its solely plant within the nineteen seventies. As the emerging need of crude oil demand, now Sri Lanka depends on foreign refined product sources because the provide capability of the CPC's plant remained as a constant. In 2011 local petroleum demand was 4200 million (Mn) liters per year and from that only one third is provided by local refined imported crude oil. The remaining amount is imported as refined products. Consequently the country is spending a large amount of money for importing crude oil products. From 2009- 2011 the petroleum bill has more than doubled. If the trend keeps on continuing like this we have to arrange a considerable proportion of resources to import crude oil.

Currently Sri Lanka is facing for several challenges in petroleum industry. Among them uncertainty of supply due to current tension in the middle east and diversification of the resources due to technological issues are main concerns. The recent crude oil crisis in Sri Lanka is also attributed to the limited supply of crude oil. Although we have a duopoly market for crude oil in Sri Lanka, both are import dependent to a larger extent. Hence the challenges remain the same as the overall demand for crude oil is rapidly increasing.

As in 2011 petroleum accounts for 24% of import bill and 45% of exports. Hence more resources will be required for imports in absolute and relative terms in future [16].

As it is an emerging need to get an idea about the future crude oil demand and also its determinants, the objective of this study is to explore several important factors that cause for Sri Lankan crude oil demand. Also this study aims to forecast the crude oil demand using a suitable model. Hence this thesis comprises a long run and short run models using data from 1988 – 2013. This will have significant policy implications on planning the future Sri Lankan economy and oil demand in Sri Lanka.

## II. MATERIALS AND METHODS

### A. Data Description

In this study Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Sri Lankan population and crude oil price were used to find out the effect on Sri Lankan oil demand. Since problems can occur in the interpretation of

variables when they are different units, the log form of the variables have been used for this study.

The oil demand was measured by the consumption of crude oil. The stationary condition of the first difference series was checked using the Augmented - Dickey Fuller test.

Chow - break point test was used to test the significance of a structural break down in the data set. Hence a dummy variable was used to indicate the structural break down. Cointegration was checked with the use of Trace statistic test. The Vector Error Correction Methodology was used to find a model for Sri Lankan crude oil consumption.

Then the stationary condition of the error term of the Vector Error Correction Model was checked using the Augmented - Dickey Fuller unit root test and a residual analysis was carried out to check the validity of the model. All the data have been collected using online resources of World Bank and United States Energy Information Administration. The sample period for this study is 1988 through 2013. The software employed in this research is EViews 8.0. The description of variables used in this research study is given below.

- LNCON – Log of Oil Consumption in Sri Lanka
- LNGDP – Log of Gross Domestic Product (GDP)
- LNFDI – Log of Foreign Direct Investment (FDI)
- LNPOP – Log of Sri Lankan Population
- LNOILPRICE – Log of Crude Oil Price

### B. Stationary Test

The most widely used test to check the stationary condition is the unit root test. The presence of unit root indicates that the data series is non stationary. There are two standard procedures of unit root test namely the Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. This study has used the Augmented Dickey Fuller (ADF) test to check the stationary condition of the series.

### C. Vector Error Correction Model and Cointegration Test

Engle and Granger (1987) point out that a linear combination of two or more non stationary series may be stationary. The stationary combination may be interpreted as the cointegration, or equilibrium relationship between the variables.

A Vector Error Correction Model (VECM) is a restricted Vector Auto Regression (VAR) model. The Vector Error Correction specification restricts the long run behavior of the endogenous variables to converge to their long run equilibrium relationships and allow the short run dynamics.

The VAR model is a general framework used to describe the dynamic interrelationship among stationary variables. So, the first step in time-series analysis should be to determine whether the levels of the data are stationary. If not, take the first differences of the series and should try again. Usually, if the levels of the time series data are not stationary, the first differences will be.

If the time series are not stationary then the VAR framework needs to be modified to allow consistent estimate of the relationships among the series. The Vector Error Correction (VEC) model is just a special case of the VAR for variables that are stationary in their differences (i.e. I(1)). The Vector Error Correction Model can also take into account any cointegrating relationships among the variables.

Suppose  $x_t$  and  $y_t$  are I(1) and cointegrated. Then  $\epsilon_t$  is I(0) in the cointegrating equation

$$y_t = \alpha + \beta x_t + \epsilon_t \quad (1)$$

These equations often are interpreted as long-run or

equilibrium relationships between  $x_t$  and  $y_t$ . A researcher will also be interested in the short-run dynamics - the way

that  $x_t$  and  $y_t$  fluctuate around this long-run relationship, as in a business cycle. This is done by estimating an error

correction model, which contains first differences of  $x_t$  and  $y_t$ , their lags, and an error correction term. An Error Correction Model is

$$\Delta y_t = \mu + \gamma_1 \Delta y_{t-1} + \dots + \gamma_p \Delta y_{t-p} + \omega_1 \Delta x_{t-1} + \dots + \omega_r \Delta x_{t-r} + \lambda EC_{t-1} + u_t \quad (2)$$

where  $\mu, \gamma_i, \omega_j, \lambda$  are the parameters of the model and  $EC_{t-1} = y_t - (a + bx_t)$ , the error correction term, is the lagged Ordinary Least Squared (OLS) residual from the cointegrating equation. Normally  $\lambda$  is expected to be negative. Then  $\lambda EC_{t-1}$  represents a force pulling  $y_t$  toward its long-run relationship, being negative when  $EC_{t-1} > 0$ , and positive when  $EC_{t-1} < 0$ .  $u_t$  is the random error. The cointegrating equation and ECM can be shown to follow from a single dynamic regression model in levels when  $y_t$  and  $x_t$  are cointegrated.

To capture the cointegration the trace test was used. The trace test examines the number of linear combinations (i.e. K) to be equal to a given value  $K_0$  (where  $K_0 = 0, 1, 2, \dots$ ), and the alternative hypothesis for K to be greater than  $K_0$ .  $H_0: K = K_0$

$$H_1: K > K_0$$

To test for the existence of cointegration using the trace test, we set  $K_0 = 0$  (no cointegration), and examine whether the null hypothesis can be rejected. If this is the case, then we conclude there is at least one cointegration relationship.

In this case, we need to reject the null hypothesis to establish the presence of cointegration between the variables of the regression.

## III. RESULTS AND DISCUSSION

Augmented Dickey Fuller (ADF) test is used to find out whether the time series variables are stationary. ADF test was performed on the examined variables at level and also at first difference series. The ADF test results are presented in table 1.

TABLE 1: AUGMENTED DICKEY FULLER (ADF) TEST RESULTS

Variables	Augmented Dickey Fuller test statistic			
	H0: Variable is non stationary			
	Level		First Difference	
	Test Statistic	P-Value	Test Statistic	P-Value
LNCON	-0.80244	0.8011	-5.760107	0.0001
LNFDI	-1.202924	0.655	-3.991209	0.0064
LNGDP	1.34889	0.9981	-4.292683	0.0028
LNOILPRICE	-0.302531	0.9113	-4.4720441	0.0011
LNPOP	-0.987396	0.74	-2.957545	0.00542

The ADF test shows that all variables are non-stationary in levels, but stationary in first difference form. Hence we can

conclude that all the variables are integrated of order one, i.e. I(1) and thus we may proceed with testing of cointegration.

#### A. Determining the order of lags in Vector Error Correction Model (VECM)

The number of lags to be used in the VECM should be determined before conduct the cointegration test.

According to table 2 lag 1 gives the values that minimize the Akaike Information Criterion, Schwarz Criterion and Standard Error. Also lag 1 model gives the maximum value for adjusted R squared. Hence Vector Error Correction model was fitted by considering up to lag 1 of all endogenous variables.

TABLE 2: LAG SELECTION CRITERIA

Lag length	Adj. R-squared	Akaike (AIC)	Schwarz Criterion (SC)	Standard Error
1	0.849	-4.511515	-4.069745	0.022044
2	0.659542	-3.72514	-3.033969	0.032677

#### B. Cointegration Analysis

Table 1 shows that all variables are integrated in same order. Hence Johansen cointegrated test was used to explore the long run relationship among the variables. As for the results of table 3, trace test indicates that there are two cointegration equations between log values of Consumption, Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Oil Price and Population at 5% level of significance. Hence we can conclude that a Vector Error Correction model can be used to model the relationship between these variables.

Cointegrating Eq:	CointEq1	CointEq2
LNCON(-1)	1.000000	0.000000
LNFDI(-1)	0.000000	1.000000
LNGDP(-1)	-1.115634 (0.11975) [-9.31647]	3.023796 (0.86638) [3.49014]
LNPOP(-1)	-6.805764 (1.08856) [-6.25209]	-7.455268 (7.87574) [-0.94661]
LNOILPRICE(-1)	1.032864 (0.07631) [13.5345]	-3.916814 (0.55213) [-7.09401]
C	126.7457	47.67044

TABLE 3: NORMALIZED COINTEGRATION COEFFICIENTS

TABLE 4: JOHANSEN COINTEGRATION TEST

Date: 11/23/17 Time: 14:20
Sample (adjusted): 3 26

Included observations: 24 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LNCON LNFDI LNGDP LNPOP LNOILPRICE				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.929030	127.5967	69.81889	0.0000
At most 1 *	0.805442	64.10492	47.85613	0.0008
At most 2	0.412280	24.81626	29.79707	0.1681
At most 3	0.267806	12.06014	15.49471	0.1541
At most 4 *	0.173698	4.579087	3.841466	0.0324
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.929030	63.49182	33.87687	0.0000
At most 1 *	0.805442	39.28866	27.58434	0.0010
At most 2	0.412280	12.75613	21.13162	0.4749
At most 3	0.267806	7.481050	14.26460	0.4339
At most 4 *	0.173698	4.579087	3.841466	0.0324
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

#### C. Long Run Relationship

After normalization, the cointegration vectors on LNCON and normalized integrated coefficients were estimated as reported in table 4.

The first normalized equation was estimated as below:

$$\text{LNCON}(-1) = 126.75 + 1.03 \text{ LNOILPRICE}(-1) - 6.81 \text{ LNPOP}(-1) - 1.12 \text{ LNGDP}(-1)$$

As it can be seen in the first normalized equation, Sri Lankan population and Gross Domestic Product (GDP) is having a negative relationship with the oil demand in the long run while price of oil is having a significant positive relationship with the demand of oil.

The second normalized equation was estimated as below:

$$\text{LNFDI}(-1) = 47.67 + 3.02 \text{ LNGDP}(-1) - 7.46 \text{ LNPOP}(-1) - 3.92 \text{ LNOILPRICE}(-1)$$

According to the second normalized equation, Foreign Direct Investment (FDI) is having a significant negative relationship with the population and oil price whereas Gross Domestic Product (GDP) is having a positive relationship Foreign Direct Investment (FDI).

#### D. Vector Error Correction Model (VECM)

The Vector Error Correction Model provides the correction terms that reflect the influences of deviation of the relationship among the variables from long run equilibrium and short run parameters. The relationship between oil demand and other macroeconomic variables can be given in the following model.

$$\begin{aligned} (\ln con_t) = & -0.1(\ln con_{t-1}) + 0.6(\ln con_{t-2}) + 0.13 * \\ & \ln GDP_{t-1} + 0.32 * \ln GDP_{t-2} - 19.97 * \ln pop_{t-2} + 23.81 * \\ & \ln pop_{t-1} - 0.13 * \ln OilPrice_{t-1} - 0.2 * \ln OilPrice_{t-2} + 0.01 * \\ & \ln FDI_{t-1} - 0.06 * \ln FDI_{t-2} + 67.19 - 0.11 * dummy \end{aligned} \quad (2)$$

TABLE 5: SIGNIFICANCE OF THE COEFFICIENTS OF VECTOR ERROR CORRECTION MODEL (VECM)

Dependent Variable: D(LNCON)				
Method: Least Squares				
Date: 11/30/17 Time: 14:03				
Sample (adjusted): 3 26				
Included observations: 24 after adjustments				
D(LNCON) = C(1)*( LNCON(-1) - 1.11563358287*LNNGDP(-1) - 6.80576412931*LNPOP(-1) + 1.03286420496*LNOLPRICE(-1) + 126.745741569 ) + C(2)*( LNFDI(-1) + 3.02379581871*LNNGDP(-1) - 7.45526834643*LNPOP(-1) - 3.91681398669*LNOLPRICE(-1) + 47.6704440648 ) + C(3)*D(LNCON(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNNGDP(-1)) + C(6)*D(LNPOP(-1)) + C(7)*D(LNOLPRICE(-1)) + C(8) + C(9)*DUMMY				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.506850	0.059477	-8.521846	0.0000
C(2)	-0.047457	0.013460	-3.525756	0.0031
C(3)	-0.591575	0.115821	-5.107665	0.0001
C(4)	0.062771	0.012959	4.843718	0.0002
C(5)	-0.320174	0.080219	-3.991242	0.0012
C(6)	19.97319	2.734885	7.303119	0.0000
C(7)	0.201533	0.034924	5.770664	0.0000
C(8)	-0.173734	0.028277	-6.143920	0.0000
C(9)	0.110398	0.021858	5.050750	0.0001
R-squared	0.901522	Mean dependent var		0.052006
Adjusted R-squared	0.849000	S.D. dependent var		0.056730
S.E. of regression	0.022044	Akaike info criterion		-4.511515
Sum squared resid	0.007289	Schwarz criterion		-4.069745
Log likelihood	63.13818	Hannan-Quinn criter.		-4.394313
F-statistic	17.16479	Durbin-Watson stat		1.714811
Prob(F-statistic)	0.000003			

The parameters of this model were estimated and shown in table 5. Table 5 consists vector error correction model for oil demand with significant error correction terms, showing explicit information on the long run and short run dynamic

interactions. As it can be seen in table 5 both error correction terms are significant with negative sign. This implies that long run movements of the variables are determined by both equilibrium relationships.

According to table 5, the estimate of C(1) which is the adjustment coefficient associated with oil demand is -0.51 and it is statistically significant. This implies that with absence of changes in oil price, population and Gross Domestic Product (GDP), deviation of the model from the long run path is corrected by 51% increase in LNCON annually. This means that the deviation from the long run relationship takes approximately 2 years (1/0.51) to eliminate the disequilibrium.

C(2) is the adjustment coefficient associated with Foreign Direct Investment (FDI). It is -0.047 and statistically significant. This implies that with absence of changes in oil price, population and Gross Domestic Product (GDP), deviation of the model from the long run path is corrected by 4% increase in LNFDI annually.

#### IV. CONCLUSIONS

FDI has a huge impact on oil demand in the long run. It has a unitary elastic effect in the long run and FDI has a small effect in increasing the overall demand for oil in the short run, with one percent rise in FDI there is only 0.06 increments in demand. FDI is a long-term strategic investment by multinational companies and it may take many years to have an influence in the country's oil demand. Hence it is unsurprising to have a small effect in the short run.

Crude oil price has a huge effect in reducing oil demand in the long run, with one percent increase in oil price there is 3.9 percent reduction in overall demand. In the short run oil demand will increase by 0.2 percent when price increase by one percent. It seems to be that when the oil price remains increased for a long period people and the industry may find alternatives to cut down the expenses by buying less amount of oil.

In the short run one percent rise in population is estimated to have 19 percent increment in oil demand and in the long run there is a reduction, with one percent rise in population there is 7 percent reduction in overall oil demand. Although population is a significant factor in the short run, there may be other factors, which have more effect on oil demand. For example, even though the population increases, if the price of the oil is high the demand will reduce in the long run.

In both long run and short run models for one percent increment in GDP, it is estimated to have a 1.11 percent and 0.32 percent reduction in the oil demand respectively. Sri Lanka's GDP mainly depends on tourism, tea export, apparel, textile, rice production and other agricultural products. These industries mainly depending on electricity and over the years proportion of electricity production by coal and hydo has increased while the proportion of electricity produced by oil has reduced significantly. Hence the industrialization in Sri Lanka, which has increased the GDP, has reduced the oil demand in both short run and long run.

According to variance decomposition, oil demand (LNCON) is relatively less exogenous in relation to the

shocks of macroeconomic variables in the short run because if considering only two years, the oil demand or the consumption of oil (LNCON) is the most important variable to account for its own innovation, which is nearly 64%. Contribution of Foreign Direct Investment (FDI), Gross Domestic Product (GDP), population and oil to the forecast error variance is 14.26%, 9.68%, 1.82% and 10.23% respectively.

At the end of the period, only 14.96% of variance of consumption is explained by its own shock. Foreign Direct Investment (FDI), Gross Domestic Product (GDP) and population are the next most important variables to be considered in explaining the forecast error variance, which accounts 37.39%, 22.23% and 18.48% impact on consumption of oil respectively. This implies that Foreign Direct Investment (FDI), Gross Domestic Product (GDP) and population prove to be the most significant factors that explain the movement in oil demand in the long run.

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# Crucial Factors that Affect Shortage of Skilled Workers for Construction Projects

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**Abstract**—This research paper defines the most crucial factors affecting to skilled worker shortage and ways to overcome from this issue with their significance outcome. Construction projects are frequently subject to problem of skilled worker shortage, which constrains project execution. Since construction is a worker intensive industry, the shortage of worker has become the crucial risks that hindering the construction project in achieving its success. However, by conducting this research the researcher may address the specific objectives of this research as well which basically finds the relationship of crucial factors with the skilled worker shortage. However, in order to conduct this research on this topic the researcher may analyse the existing knowledge on this skilled worker shortage.

**Keywords**—construction, skilled worker, crucial, shortage, significance, construction projects, salary scale, worker migration

## I. INTRODUCTION

In line with the principle of construction development, it is necessary for a country to have a sustainable construction industry, which is guided by construction projects. (Project Management Institute, 2008)

Construction projects are frequently subject to the problem of skilled worker shortage, which constrains project execution. According to Economy next article annual investment in new homes, roads and ports which has hovered at around 600 billion rupees (\$4 billion) in recent years is expected to almost triple to \$11.6 billion in 2017. But Sri Lanka needs 400,000 new workers to achieve this target. An individual labourer such as a mason or carpenter receives a minimum average salary of Rs. 1500 per day according to the Sri Lankan statistics from different sources. However we can say that this is not sufficient or workers are not getting paid regularly since we are facing a major skilled worker shortage in construction projects. Construction is not only constructing buildings. It involves many other types of work aside from the building process, such as painting, landscaping, electrical supply, telecommunications, plastering and paving. However it has been observed that many institutes provide facilities for courses such as management degrees and engineering courses but may not provide any training or education directly related to these above mentioned jobs which will affect the decline in worker force. In addition, women outnumber men and large proportions of women attend management and accounts training programmes rather than working in

fields or doing minor worker jobs. Their lack of motivation will lead towards skilled worker shortage. Skilled worker shortage is lead by many factors and some factors may be unique to only a Sri Lankan context such as low salary scale, social prestige, safety standards, reluctance in getting in to skilled employment, worker migration, and lack of government support. There are two types of objectives that the researcher is keen to achieve through this research. They are namely, general objectives and specifics objectives. General objectives include identifying factors that influence the shortage of skilled workforce for construction projects, the impact on shortage of skilled workforce due to above-mentioned crucial factors, and to suggesting a recommendation to mitigate the shortage of skilled workforce for construction projects. Specific objectives are to find out the relationship between independent variables and skilled worker shortage on construction. In this research the researcher has built up research hypothesis based on these general and specific objectives and there are altogether nine research hypotheses and they consist of the null hypothesis ( $H_0$ ) and alternative hypothesis ( $H_A$ ).  $H_0$  represents there is no significant level of relationship between each of the independent variables towards the skilled worker shortage for construction projects.  $H_A$  represents there is a significant level of relationship between each independent variable towards the skilled worker shortage for construction projects.

## II. MATERIALS AND METHOD

In order to gather data, researcher primarily used five point likert scale questionnaire and to analyse data researcher used SPSS package. The analysis of data by the researcher includes reliability of measurement of each variable. Each variable has been identified as a reliable variable since they exceed cronbach's Alpha value 7.

## III. RESULTS

TABLE I. PEARSON CORRELATION BETWEEN DEPENDENT AND INDEPENDENT VARIABLE

Independent Variable	Pearson Correlation	Cronbach's Alpha Value
Salary Scale	0.853 (85.3%)	0.759
Social Prestige	0.898 (89.8 %)	0.744
Safety standards	0.875 (87.5%)	0.738
Reluctance of females getting in to skilled employment	0.717 (71.7%)	0.751
Worker migration	0.580 (58%)	0.741
Training and education	0.856 (85.6%)	0.727

Government support	0.900 (90%)	0.828
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#### A. Salary scale

In salary scale research has focused on mainly four statements namely "I am satisfied with the current salary amount and other benefits of skilled workers that have been provided by the organization relevant to their job position to conduct the job properly", "I highly recommend the current salary scale of skilled workers provided by the organization", "I am satisfied with the reliability of providing salary on time for skilled workers by the organization" and "I am satisfied with the policies and procedures that have been enforced by the organization regarding the salary scale of skilled worker". Each statement proves its reliability since it exceeds its given cronbach's alpha value. When it comes to salary scale, for four statements cronbach's alpha value will be 0.639, 0.684, 0.688 and 0.794 which total up to 0.759 which shows the reliability of this variable to conduct this research.

According to these research findings, it shows that there is a strong relationship between salary scale and skilled worker shortage. When salary scale is changed by 1 % skilled worker shortage will be changed by 89% approximately. Since the correlating is significant at 0.01 it implies that there is a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.

H<sub>1A</sub>– There is a significant level of relationship between salary scales towards the skilled worker shortage for construction projects

#### B. Social prestige

In social prestige, researcher has focused on three main statements such as "Skilled worker's work is appropriately recognized in the organization and well within the society", "I highly recommend this organization and job facilities to others to fill the available job vacancies related to skill workers of the organization" and "In the last few months, skilled worker was recognized and appreciated for doing a good job". Each statement proves its reliability since it exceeds cronbach's alpha value. When it comes to social prestige each statement has been provided 0.631, 0.559 and 0.792 cronbach's alpha value, which leads to 0.744 total value.

According to these research findings, it shows that there is a strong relationship between social prestige and skilled worker shortage. When social prestige is changed by 1 % skilled worker shortage will be changed by 85% approximately. Since the correlating is significant at 0.01 it indicates that there is a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.

H<sub>2A</sub>– There is a significant level of relationship between social prestiges towards the skilled worker shortage for construction projects.

#### C. Safety standards

In safety standards variable again research has focused on four main statements such as "I am satisfied with the work place and tools that skilled worker use to conduct the project in efficient and effective manner," "I am satisfied with the current safety standards that have been enforced by the organization", "I am satisfied with the quality, reliability and technological advancement of the equipment used by the organization" and "I am satisfied with the level of trust the organization has shown towards skilled worker in the case of safety issues". Each statement has cronbach's alpha value 0.671, 0.679, 0.605 and 0.736 which leads to the total amount of 0.738 cronbach's alpha value.

According to this variable it shows that there is a strong relationship between safety standards and skilled worker shortage. When safety standard is changed by 1 % skilled worker shortage will be changed by 87% approximately. At the same time since the correlating is significant at 0.01 it indicates that there is a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.

H<sub>3A</sub> – There is a significant level of relationship between safety standards towards the skilled worker shortage for construction projects.

#### D. Reluctant of females getting in to skill employment

In reluctant of females getting in to skill employment mainly focused on three statements namely "I am happy that it has been given more recognition for male workers rather than female workers", "I am happy to suggest females getting in to skill employment and do innovative things at work" and "My organization has always encouraged the male workers rather than the female workers". Each statement has been proved as a reliable statement since this variable exceeds cronbach's alpha value. This shows it has total cronbach's alpha value 0.751 where each variable may have 0.637, 0.683 and 0.685 respectively.

According to this variable it shows that there is a strong relationship between reluctant of females getting in to skilled employment and skilled worker shortage. When female employment is changed by 1 % skilled worker shortage will be changed by 71% approximately. At the same time correlating is significant at 0.01, which shows that there is a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.



H4A – There is a significant level of relationship between reluctant of females getting in to skilled employment towards the skill skilled worker shortage for construction projects.

#### *E. Worker migration*

In worker migration three main statements had taken into consideration such as “I am willing to migrate to another country due to more benefits that they provide for me”, “I am satisfied with the current organization rather than working in a foreign organization” and “I am satisfied with the benefits and facilities provided by the local organization when it compares with the foreign organization”. In this variable as it can be seen in the graph cronbach’s alpha value will be 0.741 and for each statement it has given 0.656, 0.561 and 0.757 cronbach’s alpha value.

According to this variable there is no any strong relationship between worker migration and skilled worker shortage. When worker migration is changed by 1% skilled worker shortage will be changed by 58%. This shows there is no any strong relationship between them. At the same time there is a significant level of relationship between these two variables. In that case it rejects null hypothesis of this variable where it proves that, H<sub>5A</sub> – There is a significant level of relationship between worker migrations towards the skilled worker shortage for construction projects.

#### *F. Training and education*

This variable it has three main statements namely “I am satisfied with the training programme provided for skilled workers by the organization”, “In the last few months, skilled worker was recognized and praised for doing a good job” and “Last year, skilled worker was given opportunities at work to learn, grow and promote”. Here in this variable it has 0.727 cronbach’s alpha value where each statement may have 0.630, 0.716 and 0.555 cronbach’s alpha value respectively.

According to this variable it shows that there is a strong relationship between training and education and skilled worker shortage. When training and education is changed by 1 % skilled worker shortage will be changed by 85% approximately. Since the correlating is significant at 0.01, which proves that, there is a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.

H<sub>6A</sub> – There is a significant level of relationship between training and education for skilled worker towards the skilled worker shortage for construction projects.

#### *G. Government support*

Government support is the final independent variable under this research where it has three main statements namely “I am satisfied with the current standards, rules

and regulations on skilled employment that have been enforced by the government”, “I am satisfied the fact that skilled workers get to was treated equally with other types of job employment” and “I am given the opportunity to suggest improvements for skilled employment including preparing suitable policies and procedures for skill employment”. This variable has got the highest cronbach’s alpha value which is 0.828 which indicates the most reliable variable would be government support. Each statement may have cronbach’s alpha value respectively 0.703, 0.828 and 0.752. Each variable has internal consistently where all seven independent variables are can be identified as reliable variables.

According to this variable it shows that there is a strong relationship between government support and skilled worker shortage. When government support is changed by 1 % skilled worker shortage will be changed by 90% approximately. Since the correlating is significant at 0.01 leads to a significant level of relationship between social prestige and skilled worker shortage. In that case the null hypothesis is rejected. This proves followings in the research.

H<sub>7A</sub> – There is a significant level of relationship between government supports towards the skilled worker shortage for construction projects.

Analysis of regression and correlation show that in each variable there is a significant level of relationship between independent variable and dependent variable. Government support has the strongest relationship with skilled worker shortage. Salary scale, safety standards, social prestige, reluctance of females getting in to skilled employment, training and education has strong relationships with dependent variable, while worker migration does not have a strong relationship with the dependent variable. According to these research findings it says all the independent variables together explained the skilled worker shortage variable by 88%. According to all the data, conceptual framework, and ultimately whole research will be accepted since sig. value is 0.000. The conclusion of the research is accepted since the conceptual framework is correct.

#### IV. DISCUSSION AND CONCLUSION

As per the conclusion of this research identifying the skilled worker shortage for construction projects will be a major issue that need to be taken care of in order to close the gap between skilled workers demand and supply. Especially this study will help local construction organizations to recruit a skilled workforce and maintain the productivity of the construction projects to develop Sri Lankan construction industry. It will also assist in reducing factors, which affect underutilization of skilled workforce and increase the level of performance of the skilled workers. As per the recommendations, researcher suggests a pay based on experience level by establishing a

proper compensation system to improve the salary scale. Giving routine evaluations for each skilled worker, offer special projects to hardworking employees, giving certificates from the relevant technical institutes can be seen as ways to improve social prestige. Among others researcher recommends to give more education regarding safety standards rather than implementing more procedures and to give sufficient health insurance coverage for each skilled worker that can be used to improve safety standards of employees. To promote female worker employment conducting female training programmes for skilled work and educating of females about skilled work of projects can be recommended. In order to prevent worker migration, we can simply provide more benefits and facilities for skilled workers; reduction of foreign skilled workers, providing a sufficient hourly rate can be implemented. Adequately promote skilled worker education in the middle of the process and provide adequate training for these skilled worker jobs in finally adopting more policies and procedures for skilled employment can be taken as the ways to improve training, education and government support for the skilled worker.

#### V. FURTHER WORK

As per the limitations of this project, this study covered only chosen factors/variables influencing skilled worker shortage and hence there may be some other factors influencing skilled worker shortage only for construction projects, and this study only focuses about skilled worker shortage based on a sample size of one

hundred hence there semi skilled and unskilled have not been considered here. At the same time this research is focused on construction projects hence there may be other projects, which face the same issue such as IT projects, apparel projects like wise. Those types of projects have not been considered in here.

#### ACKNOWLEDGEMENT

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# Sri Lankan Travel & Tourism Industry: Recent Trends and Future Outlook towards Real Estate Development

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**Abstract—** Tourism is considered as an important economic activity around the world due to its direct economic impact as well as its significant indirect and induced impacts. According to the World Travel and Tourism Council, Travel & Tourism industry is one of the world's largest economic sectors accounts for 10.4% of global GDP and 313 million jobs, or 9.9% of total employment, in 2017. Direct and indirect impact of this on real estate development in the world is tremendous in terms of accommodation, catering to food and beverages, leisure pleasure & relaxation and so on. In Sri Lanka, tourism is the third largest export earner in the economy and during the past five years, there has been an unprecedented growth in the industry. But tourism in Sri Lanka has much more untapped potential where the industry is poised to offer great growth and investment potential. And through right policies and investment decisions, Sri Lanka can leverage the economic prospects of Travel & Tourism Industry. This study analyses the importance of travel & tourism industry in terms of real estate development and reviews major trends that are shaping the growth and development of the travel & tourism industry in Sri Lanka. This will be important to policymakers in preparing right policies and in making the right investment decisions. The analysis is based on modified Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008) published by World Travel & Tourism Council, and carried out analyzing both academic and non-academic publications, including published journal articles, annual and quarterly reports published by United Nations' World Tourism Organization, World Travel & Tourism Council, World Economic Forum and Sri Lanka Tourism Development Authority and through the raw data obtained by World Travel & Tourism Council for Sri Lanka. As per the analysis, the future outlook is bright for the tourism sector in Sri Lanka, and the country is expected to maintain a high rate of growth well into the next decade.

**Keywords –** tourism trends, real estate trends, real estate development, travel & tourism industry, Sri Lanka

## I. INTRODUCTION

Tourism is an economic and social phenomenon, which has experienced a continuous growth and deepening diversification over the decades. At present, for many regions and countries, tourism has become an important, even vital source of revenue and is one of the fastest growing economic sectors in the world. Its significance was recognized in the Manila Declaration on World Tourism of 1980 as "an activity essential to the life of nations because of its direct effects on the social, cultural, educational, and economic sectors of national societies and on their international relations (The World Tourism Conference, 1980). Tourism delivers large amounts of revenue into the

economy in the form of spending for goods and services, which are essential for tourists. As per the World Tourism Organisation, 10% of World's GDP is contributed by the Travel & Tourism Industry and one out of every ten jobs are related to the industry (UNWTO, 2017). Travel & Tourism Industry accounts for almost 1.4 trillion U.S. dollars, which are 7% of the World's exports and 30% of services exports (UNWTO, 2017).

Sri Lanka is often considered as an increasingly popular destination for international tourists, as well as for expatriates who return home to visit relatives and friends. Lonely Planet ranked Sri Lanka as the number one destination to visit in 2013. In 2015, Forbes magazine declared Sri Lanka among the "top ten coolest countries" to visit (Abel, 2014). Also, in 2016 Lonely Planet, Rough Guides, The Guardian, The New York Times have identified Sri Lanka as a top location to visit (Ministry of Tourism Development and Christian Religious Affairs, 2017). Travel & Tourism Industry is the third largest export earner in the Sri Lankan Economy, after remittances, textiles and garments. At present Sri Lanka is experiencing an unprecedented growth in visitors, averaging more than 22% year on year (Ministry of Tourism Development and Christian Religious Affairs, 2017). First-time in 2016, Tourism in Sri Lanka has surged to a milestone of over 2 million tourists arrival which is a remarkable increase of 14% over 1.8 million tourist arrivals in 2015 (Sri Lanka Tourism Development Authority, 2017). In 2016, international visitors stayed an average of 10.2 nights and generated 3.5 million U.S. dollars (Sri Lanka Tourism Development Authority, 2017). Asian visitors continued to be the main source of tourism to Sri Lanka accounting 45.1% of the total share followed by Western Europe with a share of 31.4% (Sri Lanka Tourism Development Authority, 2017). The occupancy rate of graded accommodation has shown 74.76% where the total guest nights recorded in tourist hotels has increased to 10.6 million nights in 2016 which is an 18.4% of growth compared in 2015 (Sri Lanka Tourism Development Authority, 2017).

Tourism is highly dynamic and competitive industry, which requires the ability to constantly adapt to tourists' rapidly changing needs and desires, as the tourist's satisfaction, safety, and enjoyment are the prime focus of travel and tourism industry. In order to make Sri Lanka competitive in the global travel & tourism marketplace and to utilize the full potential of the industry to the economy, right policies and investment decisions are essential. The Sri Lanka Tourism Strategic Plan 2017-2020 is a major step taken by Ministry of Tourism Development and Christian Religious Affairs in this regard. However, it is perhaps one

of the curious anomalies of travel and tourism studies as strange that more academics have not devoted their attention to the impacts surrounding real estate development. In the end, real estate is fundamental to tourist experiences whether it is in the form of an accommodation at a luxury five-star hotel complex, the excitement of a theme park, or obviously, walking through an untouched wilderness area. Real estate is vital to tourism business, simultaneously, as a principal asset and a major source of costs. Destination development is in no small measure a function of the resolution of real estate markets among competing land uses.

## II. PURPOSE OF STUDY

The purpose of this research is to analyze the economic importance of tourism and review the major trends that are shaping the growth and development of the travel & tourism industry along with the real estate sector in Sri Lanka.

## III. THE SIGNIFICANCE OF THE STUDY

2017 was declared as the International Year of Sustainable Tourism for Development by United Nations General Assembly (UNESCO, 2017) recalling the potential of tourism to advance the universal 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs) (Nations, 2015). The International Year aims to support a change in policies, business practices and consumer behavior towards a more sustainable tourism sector that can contribute effectively to the SDGs. This is fitting for Sri Lanka as the country embarks on a journey of transformation of its tourism sector.

This paper aims to explore emerging trends in travel and tourism industry in Sri Lanka; a region that has seen high growth and contribution to the local economy in many ways over the recent years and is poised to be the center of tourism in the near future. Knowledge gaps are identified as an agenda for future research to better understand tourism and its impact on real estate development in Sri Lanka.

This research aims to provide a guide for academic researchers to identify future research opportunities in Sri Lankan travel & tourism industry that will be of benefit to policymakers, academia, industry and for the wider society.

## IV. OBJECTIVES

### A. General Objective

To analyze major trends associated with travel & tourism industry and its impact on real estate development in Sri Lanka.

### B. Specific Objectives

To identify the importance of the Travel & Tourism Industry towards real estate development in Sri Lanka.

To analyze the performance of key economic indicators related to the Travel & Tourism Industry in Sri Lanka.

## V. METHODOLOGY

The Contribution of Travel & Tourism Industry can be explained using Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008) published by Statistics division of World Tourism Organization (United Nations, 2011). According to TSA: RMF 2008, the framework only recognize the direct contribution of Travel & Tourism Industry. But the industry has significant indirect and induced impacts which were

overlooked in the framework. World Travel & Tourism Council recognizes those indirect and induced impacts through its researches (World Travel & Tourism Council, 2018). This study follows the modified TSA: RMF 2008 (Figure 1) published by World Travel & Tourism Council in order to identify and explain the economic importance and trends of travel & tourism industry in Sri Lanka.

Fig. 1. Tourism Satellite Account: Recommended Methodological Framework 2008

Direct Contribution	Indirect Contribution	Induced Contribution	Total Contribution
<ul style="list-style-type: none"> <li>•Commodities</li> <li>•Accommodation</li> <li>•Transportation</li> <li>•Entertainment</li> <li>•Attractions</li> <li>•Industries</li> <li>•Accommodation Services</li> <li>•Food &amp; Beverage Services</li> <li>•Retail Trade</li> <li>•Transportation Services</li> <li>•Cultural, Sports &amp; Recreational</li> <li>•Sources of Spending</li> <li>•Residents' Domestic Travel &amp; Tourism Spending</li> <li>•Businesses' domestic spending</li> <li>•Visitor exports</li> <li>•Individual Government Travel and Tourism Spending</li> </ul>	<ul style="list-style-type: none"> <li>•Travel &amp; Tourism investment spending</li> <li>•Government collective Travel &amp; Tourism Spending</li> <li>•Impact of purchases from suppliers</li> </ul>	<ul style="list-style-type: none"> <li>•Food &amp; Beverages</li> <li>•Recreation</li> <li>•Clothing</li> <li>•Housing</li> <li>•Household goods</li> </ul>	<ul style="list-style-type: none"> <li>•To GDP</li> <li>•To Employment</li> </ul>

Source: United Nations, 2011

The trends were identified through a review of both academic and non-academic publications including published journal articles, annual and quarterly reports published by United Nations' World Tourism Organization, World Travel & Tourism Council, World Economic Forum and Sri Lanka Tourism Development Authority and through a descriptive analysis of the raw data obtained by Data Gateway of World Travel & Tourism Council.

## VI. LIMITATIONS

1. The trends were identified by using the performance of selected key economic indicators of the Travel & Tourism Industry.

2. The results that have been concluded is based on the data and information available for Sri Lanka and it might be not the same for other countries or regions.

## VII. LITERATURE REVIEW

As the article focuses on analytical methods, a brief review of trends identification in the Travel and Tourism Industry is provided here. According to Tolkach et al., 2016, a change can be described using three different key terms; "fad", "trend" and "megatrend". "Fad" is a change for a very short period devoid of any significance or societal insinuations (Tolkach et al., 2016). "Trend" is a phenomenon which is of greatest significance on society that is typically long-lasting. The term "trend" has to turn out to be a very prevalent term and may be applied to changes in diverse contexts and to phenomena of significance (Nordin, 2005). The term "megatrend" has been defined by Oxford Dictionary, 2018, as an "important shift in the progress of a society or of any other particular field or activity; any major movement" which will have greater and long-lasting impacts than trends. The time span of trends typically ranges from 1 to 2 years where it may extend to a decade and beyond (Pan et al., 2008).

Trends analyses methods involve quantitative analysis of statistical data and survey results and qualitative analysis of interviews and/or the Delphi approach (Tolkach et al., 2016). Peng, Song & Crouch, 2014 states that the quantitative approaches are more well known in modeling and forecasting demand. But, the drawback of the dependence on historical data to predict future might be unreliable because of the varying political, social and economic situations in addition to unexpected disasters (Prideaux et al., 2003). In the case of qualitative approach, researchers like Tolkach et al., 2016; Ballantyne et al., 2009; Buckley et al., 2015; Tribe, 2008; Xiao and Smith, 2006, adopt content analysis to explore trends in the tourism sector. Researchers like Yeoman (2009, 2012) adopt scenario planning to discuss what future tourism by 2030 and 2050 will be. This method generally aims to recognize key factors and/or uncertainties effect on a phenomenon.

Various leading industry organizations have been analyzing travel and tourism trends. For example, the United Nations' World Tourism Organization annually publishes Tourism Highlights which identify arrivals and expenditure. Also, the World Tourism and Travel Council focus on long-term trends in the economic impact of travel and tourism activities and publishes monthly updates. Pacific Asia Travel Association (PATA, 2014) a leading organization in the region, publishes thematic reports on regional travel-related issues and trends. Jones Lang LaSalle Incorporated (JLL) which is a professional service and investment management company specializing in real estate also publishes annual reports on the trends and performance of travel and tourism industry. As the local apex body related to travel and tourism, Sri Lankan Tourism Development Authority (SLTDA) too publishes reports on the performance and trends of travel and tourism industry in Sri Lanka.

## VIII. DATA ANALYSIS

### A. Direct Spending Impacts

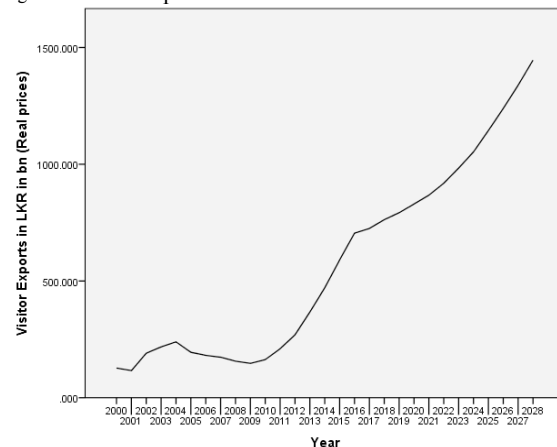
#### 1) Visitor Exports

As per the Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008), Visitor Exports are the spending within the country by international tourists for both leisure and business trips, including spending on transport. International spending on education is excluded. This is consistent with the total inbound tourism expenditure in table 1 of the TSA: RMF 2008.

After the civil war ended in 2009, Visitor Exports in Sri Lanka has dramatically increased over time wherein 2017 Travel & Tourism industry has generated LKR 725.2 billion Visitor Exports which is 25.3% of total exports in 2017. And it is expected to grow by 5.1% per annum in 2018 and

will continue to rise by 6.6% per annum from 2018 to 2028 to LKR 1445.7 billion by 2028 (30.2% of total exports).

Fig. 2. Visitor Exports



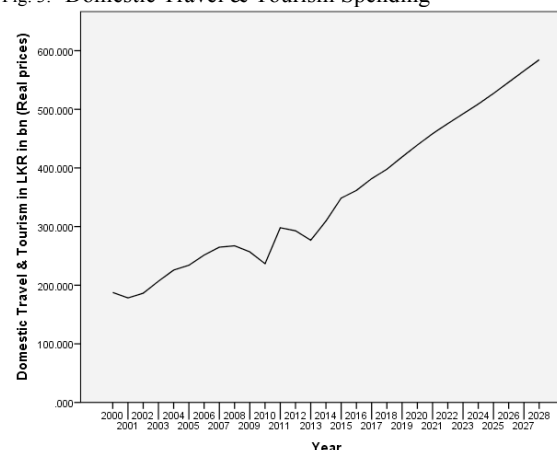
Source: WTTC, 2018

#### 2) Domestic Travel & Tourism Spending

Spending within a country by that country's residents for both business and leisure trips are considered as Domestic Travel & Tourism Spending. But multi-use consumer durables are not included since they are not purchased solely for tourism purposes. This is consistent with total domestic tourism expenditure in table 2 of the TSA: RMF 2008. Also, Outbound spending by residents abroad is not included and is separately identified according to the TSA: RMF 2008.

There has been a steady growth in Domestic Travel & Tourism Spending over the years except for some drop in 2010 and 2013. Travel & Tourism Industry has recorded LKR 381.8 billion Domestic Travel & Tourism Spending. And it is expected to grow by 4.2% per annum in 2018 and will continue to rise by 3.9% per annum from 2018 to 2028 to LKR 584.6 billion by 2028.

Fig. 3. Domestic Travel & Tourism Spending



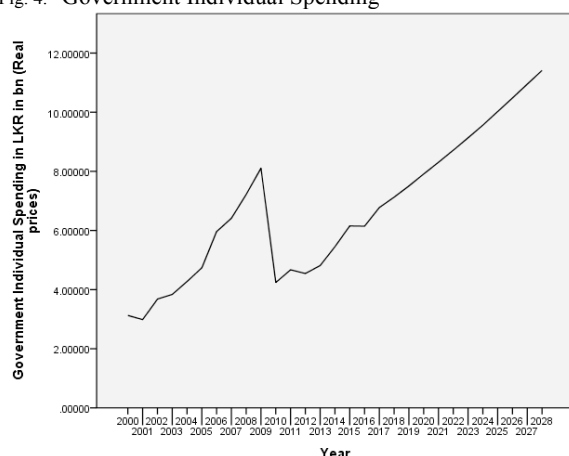
Source: WTTC, 2018

### 3) Government Individual Spending

According to Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008), spending by the government on Travel & Tourism services directly linked to visitors, such as cultural services (eg museums) or recreational services (eg national parks) is identified as Government Individual Spending.

Over the past 17 years, Government Individual Spending in Travel & Tourism Industry has shown a sharp growth except in 2010, recorded a significant drop but from 2011 the trend has continued to grow where in 2017 Government Individual Spending was LKR 6.8 billion. And it is expected to grow by 4.5% per annum in 2018 and will continue to rise by 5.5% per annum from 2018 to 2028 to LKR 11.4 billion by 2028.

Fig. 4. Government Individual Spending



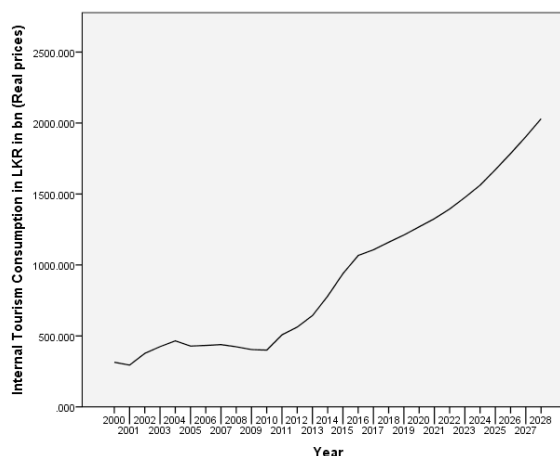
Source: WTTC, 2018

### 4) Internal Tourism Consumption

Internal Tourism Consumption is the total revenue generated within a country by industries that deal directly with tourists including visitor exports, domestic spending, and government individual spending. This does not include spending abroad by residents. This is consistent with total internal tourism expenditure in table 4 of the TSA: RMF 2008.

In overall Internal Tourism Consumption in Sri Lanka has shown a steady growth as in 2017, it was LKR 1107 billion. And it is expected to grow by 4.8% per annum in 2018 and will continue to rise by 5.8% per annum from 2018 to 2028 to LKR 2030.3 billion by 2028.

Fig. 5. Internal Tourism Spending

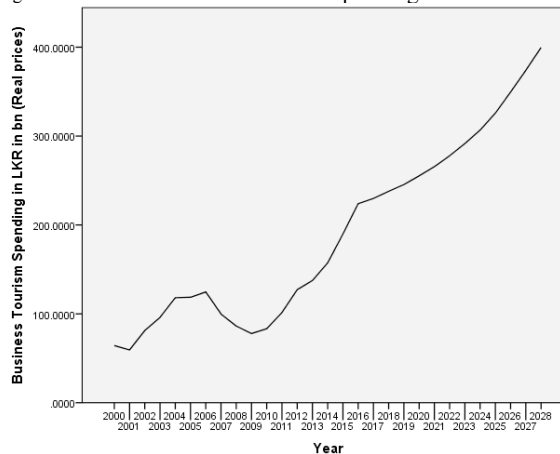


Source: WTTC, 2018

### 5) Business Travel & Tourism Spending

Spending on business travel within a country by residents and international visitors is represented in Business Travel & Tourism Spending. As per the figure below, there has been a dramatic increase in Business Travel & Tourism Spending after 2009 and in 2017, Business Travel & Tourism Spending was LKR 229.9 billion. And it is expected to grow by 4.9% per annum in 2018 and will continue to rise by 4.8% per annum from 2018 to 2028 to LKR 399.6 billion by 2028.

Fig. 6. Business Travel & Tourism Spending

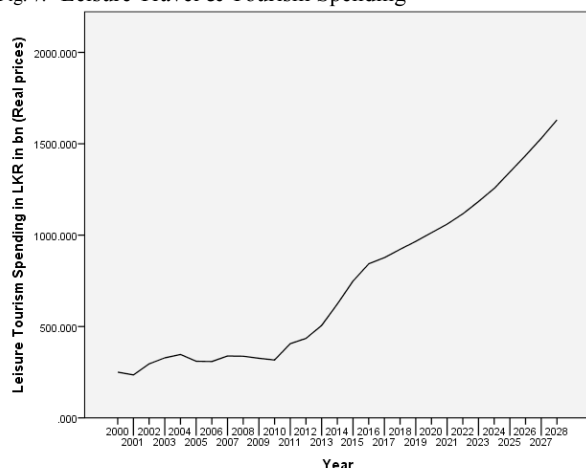


Source: WTTC, 2018

### 6) Leisure Travel & Tourism Spending

Leisure Travel & Tourism Spending consists of spending on leisure travel within a country by residents and international visitors. There has been a significant increase in Leisure Travel & Tourism Spending after 2009 and in 2017, it was LKR 877.1 billion. And it is expected to grow by 5.2% per annum in 2018 and will continue to rise by 5.9% per annum from 2018 to 2028 to LKR 1631 billion by 2028.

Fig. 7. Leisure Travel & Tourism Spending



Source: WTTC, 2018

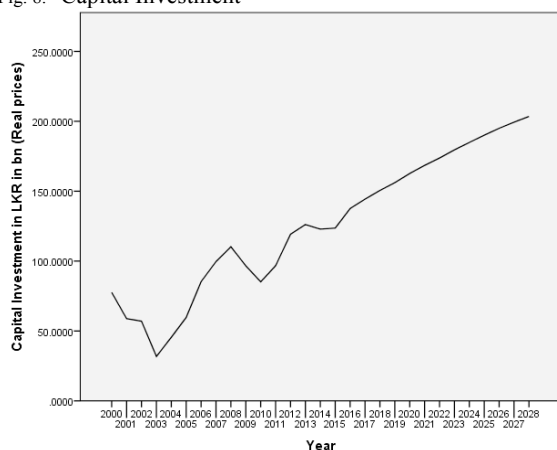
### B. Indirect and Induced Impacts

#### 1) Capital Investment

Capital Investment includes capital investment spending by all industries directly involved in Travel & Tourism. This also constitutes investment spending by other industries on specific tourism assets such as new visitor accommodation and passenger transport equipment, as well as restaurants and leisure facilities for specific tourism use. This is consistent with total tourism gross fixed capital formation in table 8 of the TSA: RMF 2008.

There has been a significant growth in Capital Investment in the Travel & Tourism Industry after 2010 and in 2017, it was LKR 144.3 billion. And it is expected to grow by 4.3% per annum in 2018 and will continue to rise by 3.1% per annum from 2018 to 2028 to LKR 203.5 billion by 2028.

Fig. 8. Capital Investment



Source: WTTC, 2018

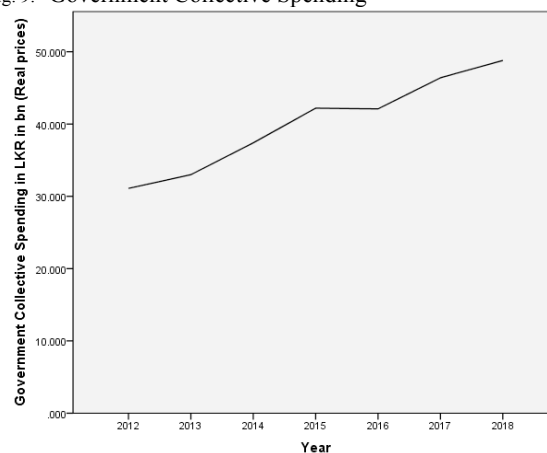
#### 2) Government Collective Spending

Government Collective Spending is the government spending in support of general tourism activity. This can

include national as well as regional and local government spending. For example, it includes tourism promotion, visitor information services, administrative services and other public services. This is consistent with total collective tourism consumption in table 9 of TSA: RMF 2008.

Government Collective Spending has shown a steady growth over the years as in 2017, it was LKR 46.4 billion. And it is expected to grow by 5.2% per annum in 2018 and will continue to rise by 4.8% per annum from 2018 to 2028 to LKR 78.2 billion by 2028.

Fig. 9. Government Collective Spending

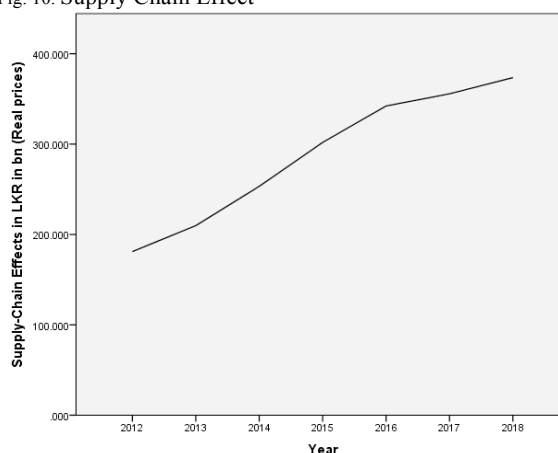


Source: WTTC, 2018

#### 3) Supply-Chain Effects

Supply-Chain Effects consists of purchases of domestic goods and services directly by different industries within Travel & Tourism as inputs to their final tourism output. As years went by Supply-Chain Effects has shown a continuous growth as in 2017, it was LKR 355.7 billion. And it is expected to grow by 5.1% per annum in 2018 and will continue to rise by 5.7% per annum from 2018 to 2028 to LKR 373.6 billion by 2028.

Fig. 10. Supply Chain Effect



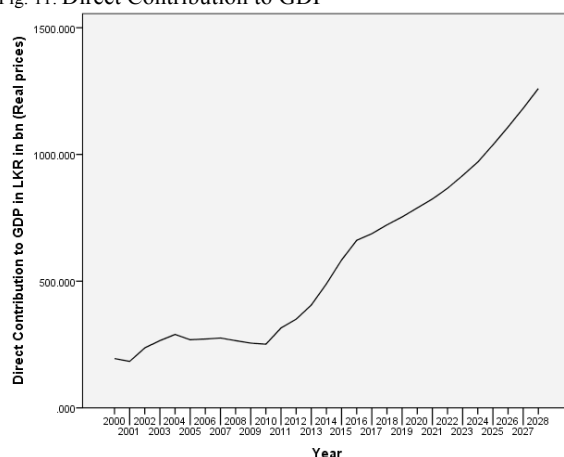
Source: WTTC, 2018

### C. Direct Contribution to GDP

It's GDP generated by industries that deal directly with tourists, including hotels, travel agents, airlines and other passenger transport services, as well as the activities of restaurant and leisure industries that deal directly with tourists. Which is equivalent to total internal Travel & Tourism spending within a country less the purchases made by those industries (including imports). In terms of the UN's Tourism Satellite Account methodology, it is consistent with total GDP calculated in table 6 of the TSA: RMF 2008.

Direct Contribution to GDP by Travel & Tourism Industry has shown an exponential growth over the years since 2010. Where Travel & Tourism Industry has directly contributed LKR 687.4 billion to GDP, which is 5.3% of Total GDP in 2017. And it is forecasted to grow by 5.1% in 2018 and continue to grow by 5.7% per annum from 2018 to 2028 which will be LKR 1,260 billion by 2028 (5.7% of total GDP).

Fig. 11. Direct Contribution to GDP



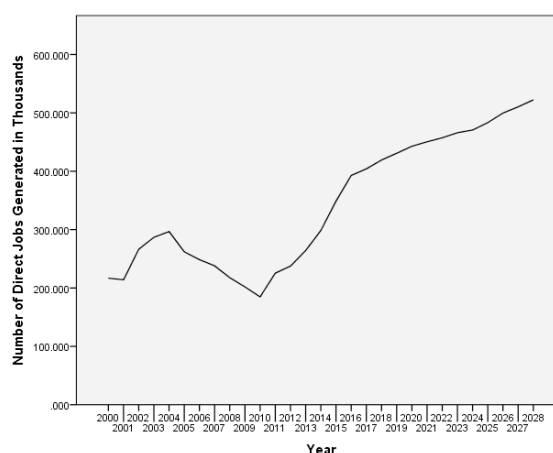
Source: WTTC, 2018

### D. Direct Contribution to Employment

Direct Contribution to Employment is the number of direct jobs within Travel & Tourism. This is consistent with total employment calculated in table 7 of the TSA: RMF 2008. 3.

Since 2010, the Travel & Tourism Industry has shown a significant growth, directly creating employment opportunities. In 2017, the Travel & Tourism Industry has directly supported 404,000 jobs which are 5.1% of total employment. It has been forecasted to grow by 3.7% in 2018 and continue to rise by 2.2% per annum up to 522,000 jobs by 2028.

Fig. 12. Direct Contribution to Employment

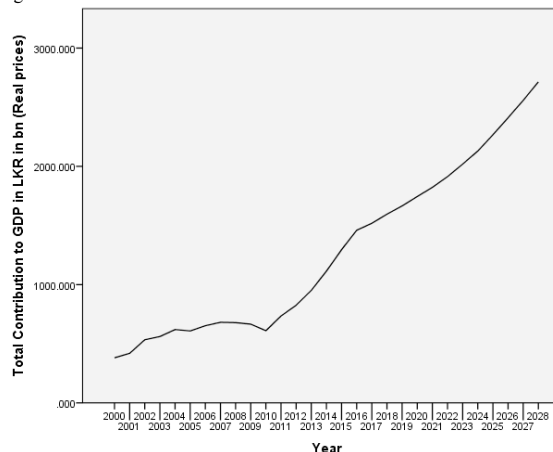


Source: WTTC, 2018

### E. Total Contribution to GDP

Total Contribution to GDP is the GDP generated directly by the Travel & Tourism sector plus its indirect and induced impacts. Travel & Tourism Industry's total contribution to GDP has shown a continuous growth after the end of civil war in 2009 and the total contribution of Travel & Tourism Industry to GDP was LKR 1518.8 billion which is 11.6% of GDP in 2017 and expected to rise by 5.1% in 2018 and continue to rise by 5.5% per annum where it will be LKR 2,714.1 billion by 2028 (12.3% of GDP).

Fig. 13. Total Contribution to GDP



Source: WTTC, 2018

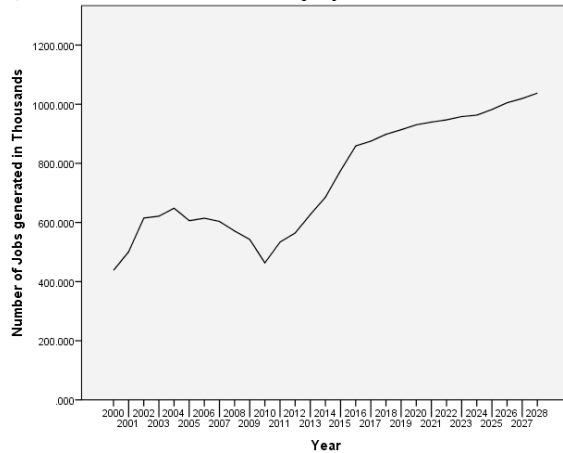
### F. Total Contribution to Employment

The number of jobs generated directly in the Travel & Tourism sector including the contributions of indirect and induced sectors. Total Contribution to Employment has shown a steady growth over the past 7 years since the end of civil war. The total contribution of Travel & Tourism Industry to employment including jobs indirectly supported by Travel & Tourism Industry was 875,000 jobs, which are 11% of total employment in 2017. And this is expected to grow by 2.6% in 2018 and continues to grow by 1.5% per



annum to 1,037,000 jobs by 2028 (12.8% of total employment).

Fig. 14. Total Contribution to Employment



Source: WTTC, 2018

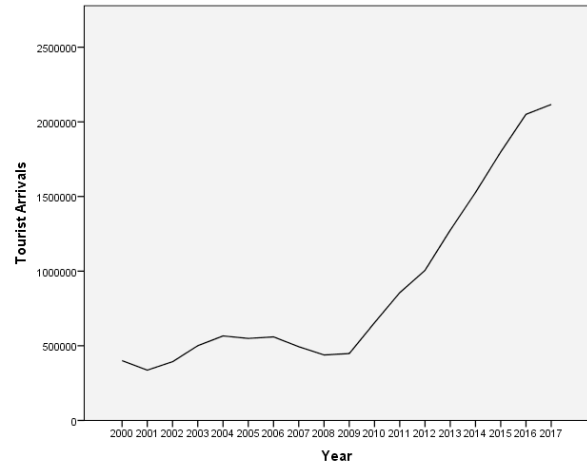
#### G. Real Estate Trends in Travel & Tourism Industry

Real Estate is central to Travel & Tourism Industry so it's not exaggerating to state that Travel & Tourism Industry has been built around Real Estate. Similarly, developing the Travel & Tourism Industry is an activity of Real Estate Development. As every commodity associated with the industry; be it is Accommodation, Transportation, Entertainment and Attractions are fundamentally a piece of Real Estate.

Real Estate Hotspots such as Colombo, Kandy, and Galle in Sri Lanka are also countries' most preferred travel destinations. As these destinations charm more tourists, the demand for better tourism commodities such as accommodation, entertainment, and retail will expand. Moreover, Sri Lanka has achieved an important landmark of 2 Million international tourist arrival in 2016 (Sri Lanka Tourism Promotion Bureau, 2014). Sri Lanka has performed well in terms of attracting foreign revenue as, IHS Incorporation; a global information company in the United States has listed Sri Lanka among the top 10 FDI hotspots in 2016 (Daily Mirror, 2016). At present many local and international companies namely Jetwing Hotels Limited, Cinnamon Hotels by John Keels Holdings, Shangri-La Group; a premier Asian luxury hotel chain, ITC Group of India, Thailand's Minor Group, RIU Hotels & Resorts in Spain, Singapore's Aman Resorts, etc., have already made investments to expand Travel & Tourism Industry in Sri Lanka (LMD, 2017). In order to facilitate increasing number of tourists, the government of Sri Lanka has invested to develop necessary public infrastructure to facilitate easy transportation links between prime cities such

as Colombo, Kandy, Gampaha and Galle such as first ever expressway from Colombo to the southern hub of Galle in 2011 and the Colombo to Katunayake expressway in 2013. Furthermore, highways from Katunayake to Anuradhapura, Colombo to the hill capital Kandy and from Anuradhapura to Jaffna is in progress.

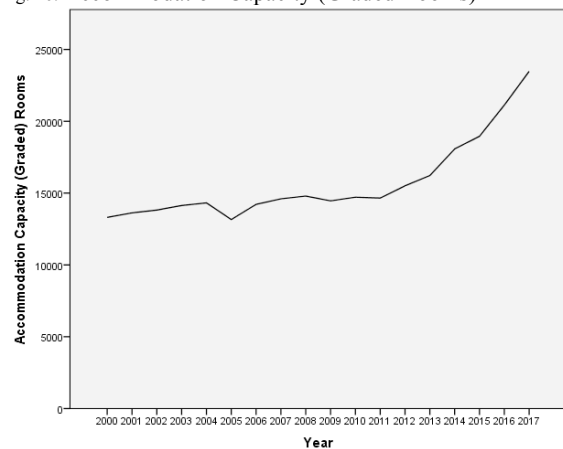
Fig. 15. International Tourists Arrivals



Source: Sri Lanka Tourism Promotion Bureau, 2018

In terms of Accommodation capacity, the total number of Sri Lanka Tourism Development Authority (SLTDA) registered accommodation establishments as at 30th June 2018 was 2,164 (SLTDA, 2018). The number of classified or graded tourist hotels was 136 and among them, 22 were five-star hotels. Importantly the presence of small and medium enterprises is strong in the hospitality market with guesthouses, homestays and bungalows recording the highest number of registered establishments with 904, 395 and 354 units respectively. The total room inventory was 36,381 and Classified tourist hotels (1-5 star) had the highest inventory of 12,822 rooms.

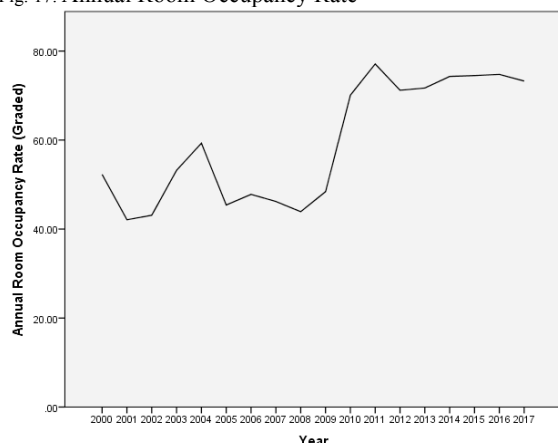
Fig. 16. Accommodation Capacity (Graded Rooms)



Source: Sri Lanka Tourism Promotion Bureau, 2018

According to the Figure 17, Formal Tourist Accommodation establishments including Star Class Hotels & Other Supplementary Establishments like Boutique Hotels, Guest Houses, Bungalows etc. have an occupancy level around 70% in recent years (Sri Lanka Tourism Development Authority, 2017).

Fig. 17. Annual Room Occupancy Rate



Source: Sri Lanka Tourism Promotion Bureau, 2018

The Table I depict the number of investment projects handled by SLTDA up to end June 2018 (SLTDA, 2018). A sum of 326 projects had been granted final approval while 115 are under construction and 171 are in operation. And 40 tourism investments projects are yet to be commenced. The number of rooms of final approval granted projects is 18,364. The total investment value of final approval granted projects is estimated at USD 2,895.3 million. The value of projects which are under construction is USD 1,044.2 million. And the investment value of projects in operation is USD 1,640 million while the value of projects that have not commenced is USD 181.6 million.

#### 1. THE PROGRESS OF INVESTMENT PROJECTS - UP TO END JUNE 2018\*

Status of the Projects	No. of Projects	No. of Rooms	Investment Value (USD mn)
Final approval granted	326	18,364	2,895.3
Under construction	115	7,460	1,044.2
Projects in operation	171	9,143	1,640.0
Projects not yet started	40	1,761	181.6

Source: SLTDA, 2018

Among the final approval granted projects, there are 22 tourism investment projects with accommodation of over 200 rooms (SLTDA, 2018). The highest number of projects (221) are those with less than 49 rooms (SLTDA, 2018).

#### ROOM DISTRIBUTION OF FINAL APPROVAL GRANTED PROJECTS - UP TO END JUNE 2018\*

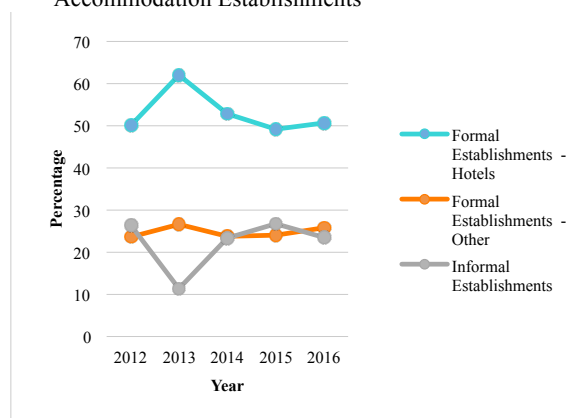
No. of Rooms	No. of Projects	Percentage (%)
Over 200	22	6.8
100 - 200	19	5.8
50 - 99	64	19.6

Less than 49	221	67.8
<b>Total</b>	<b>326</b>	<b>100</b>

Source: SLTDA, 2018

Majority of tourists (83.4%) visit Sri Lanka for the purpose of pleasure or holiday (Sri Lanka Tourism Development Authority, 2017). According to Sri Lanka Tourism Development Authority, 2017 the total number of nights spent by the 2,050,832 tourists who visited the country in 2016 amounted to 20,918,486. Foreign Tourist Nights recorded in Informal Accommodations or Unregistered Accommodation units amounted to 4,918,786 nights in 2016, which was an increase of 1.02% compared to 4,868,945 nights recorded in 2015. As a percentage about 23.51% of tourist had utilized unregistered accommodation units. It is noteworthy that from total tourist nights spent by tourists who visited Sri Lanka about 25.84% was spent in supplementary establishments (Boutique Villa, Guest Houses, Rest Houses, Home Stay Units, Tourist Bungalows, Rented Tourist Homes, Rented Tourist Apartments and Heritage Bungalows / Homes etc.). There is only 2.33% difference between the tourist nights spent in supplementary establishments and unregistered accommodation units. It is a significant change in the trend of tourist stay during the last couple of years. Such a move will encourage the investment on small boutique hotel & tourist bungalows in the future.

Fig. 18. Percentage of Guest Nights spent in Tourist Accommodation Establishments



Source: Sri Lanka Tourism Development Authority, 2017

#### IX. FINDINGS & CONCLUSION

1. Travel & Tourism Industry has directly contributed LKR 687.4 billion to GDP, which is 5.3% of Total GDP in 2017. It is forecasted to grow by 5.1% in 2018 and continue to grow by 5.7% per annum from 2018 to 2028, which will be LKR 1,260 billion by 2028 (5.7% of total GDP).
2. The total contribution of Travel & Tourism Industry to GDP was LKR 1518.8 billion which is 11.6% of GDP in 2017 and expected to rise by 5.1% in 2018 and continue to rise by 5.5% per annum where it will be LKR 2,714.1 billion by 2028 (12.3% of GDP).

3. In terms of employment, the Travel & Tourism Industry has directly supported 404,000 jobs, which are 5.1% of total employment in 2017. It has been forecasted to grow by 3.7% in 2018 and continue to rise by 2.2% per annum to 522,000 jobs by 2028.
  4. The total contribution of Travel & Tourism Industry to employment including jobs indirectly supported by Travel & Tourism Industry was 875,000 jobs, which are 11% of total employment in 2017. And this is expected to grow by 2.6% in 2018 and continues to grow by 1.5% per annum to 1,037,000 jobs by 2028 (12.8% of total employment).
  5. Travel & Tourism Industry has generated LKR 725.2 billion visitor exports, which are 25.3% of total exports in 2017. It is expected to grow by 5.1% per annum in 2018 and continue to rise by 6.6% per annum from 2018 to 2028 to LKR 1445.7 billion by 2028 (30.2% of total exports).
  6. Investments in Travel & Tourism Industry were LKR 144.3 billion in 2017 which is 4.1% of total investment in 2017. It is expected to rise by 4.3% this year and will continue to grow by 3.1% per annum over next decade to LKR 203.5 billion by 2028 (3.6% of total investment)
  7. Many local and international companies have already made investments, which will expand the current accommodation capacity within the country.
  8. A sum of 326 projects had been granted final approval while 115 are under construction and 171 are in operation. And 40 tourism investments projects are yet to be commenced.
  9. Graded Tourist Accommodation establishments including Star Class Hotels & Other Supplementary Establishments like Boutique Hotels, Guest Houses, Bungalows etc. have an occupancy level of around 70% in recent years.
  10. Tourist nights were spent in Tourist Hotels id gradually declining while tourists' nights spent in supplementary establishments and unregistered accommodation units and private houses is increasing which indicates the change of preferences in terms of tourist accommodation.
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# Analysis of Customer Feedback towards Customer Satisfaction

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**Abstract** — *Analysis of the Customer Relationship Management (CRM) process of an organization and the customer feedback towards business transactions is essential for the management to maintain better relationships with their customers to achieve higher performance. Organizational CRM process should be unique and successful to deal with its customers throughout the entire transactional period in an effective manner. The organization should be able to identify customer requirements and changing needs to satisfy its customers. Satisfaction with products or services motivates the customers to maintain their relationships with the organization. Dissatisfaction leads to complaining behavior and exit from the interaction. It is essential to measure the level of customer satisfaction and loyalty at different stages of the CRM process. Customer satisfaction and loyalty directly affect the corporate image and competitive advantage of the organization. The research emphasized that the organizations should establish efficient CRM and complaint handling processes to gain competitive advantage by satisfying their valuable customers.*

**Keywords** — *customer feedback, customer satisfaction, customer loyalty, complaining behavior*

## I. INTRODUCTION

The Customer Relationship Management (CRM) process of a leading automobile company in Sri Lanka was analyzed to identify the impact of CRM towards customer satisfaction. The increasing number of customer complaints had become a severe issue to the organizational management to rethink on their CRM process. The areas of CRM and complaint handling were reviewed while expanding the research coverage to study customer satisfaction, loyalty, feedback and complaining behavior in order to engage in more in-depth analysis beyond customer complaints.

With the high competition in the business environment, ‘customer’ is considered as an important element of all organizational activities. A better communication and relationship with customers should be maintained by organizations to achieve higher performance and competitive advantage. Organizations may fail in operation, unless they understand customer needs, values, attitudes and behavior patterns. Customer is one of the factors of Porter’s five forces model and customer services is an essential element of Porter’s Value chain model. Therefore the better management of customer relationships affects the improvement of customer satisfaction and loyalty.

## II. LITERATURE REVIEW

CRM is a commercial process in a business environment, which prepares the organizational structure to develop and survive in the industry. It is a strategic process of support against competitors by providing a value for

buyers and sellers, and gaining excellent benefits [1]. Customer satisfaction is defined as the customers’ perceived relationship between their expectations and the performance of products and services [2]. Serving customers’ undiscovered needs is a key to satisfaction and loyalty. Satisfaction increases the loyalty while having a positive and meaningful relationship among them [3].

Customers express their satisfaction with products or services in terms of specific aspects like product attributes, prices and customer services. Usage context, segment population and market environment influence satisfaction and product usage. Increasing customer satisfaction leads to higher future profitability, lower costs related to defective goods and services, increase buyer willingness to pay price premiums, provide referrals, more product usage and a higher level of loyalty. Firms have to focus on the development of high quality products and services to build long-term customer satisfaction and retention [4].

Customer loyalty is an important source of competitive advantage, which has a powerful impact on long-term profitability, and the performance of an organization. It is the buyer’s overall attachment or deep commitment to a product, service, brand or the organization [5]. Loyal buyers are more likely to focus on long-term benefits, engage in cooperative actions and much less susceptible to negative information about the service than disloyal customers. Loyalty is based on the consumer trust on vendor or product, high positive perceived value of the transactions than competitors and the positive customer emotional attachment [6]. Fig. 1 shows the relationship between loyalty and purchase behavior in a circular manner.

Customers express their dissatisfaction with the organization when the product or service performance is below their expectations. Customer complaints arise in a case of dissatisfaction and the complaining behavior differs according to their demographic characteristics. Passives, voices, irates and activist were identified as four types of complainers and incomprehension of customer expectations, wrong satisfaction standards, lack of expectation or performance and undelivered commitments were identified as four main reasons for the emergence of dissatisfaction [2]. Keep Interaction by listening to customers, offer goods and services based on the defined customer values and pay attention to the continuous changes of customer needs are stated as methods to preserve successful customers from

complaints [1]. Dissatisfied complaining customers' satisfaction with complaint resolution is positively correlated to loyalty. The initial negative affect is negatively correlated to the satisfaction with complaint resolution and loyalty. Improve service quality to reduce the number of dissatisfied customers, increase voice to reduce the number of dissatisfied non-complaining customers, and improve complaint resolution to reduce the number of lost complaining customers are defined as methods to reduce customer defects due to dissatisfaction [7].



Fig. 1. Customer Loyalty & Purchase Cycle (Jahanshahi et al., 2011)

According to Fig. 2, organizations that can build and sustain a combination of personal, product and brand loyalty lead to service provider loyalty while having a greater chance to attract customers and maintain relationships. Customer desire to do transactions with an employee is defined by the personal loyalty. Employee knowledge, competence, well behavior, attitudes, higher connections and trust with customers result in higher customer loyalty. The review of literature emphasized that the proper management of customer relationships provides flexibility in products and services and increases customer satisfaction and loyalty. Encouraging customers to complain on the drawbacks of the products, services or the CRM process increases customer loyalty. Since it is impossible to ensure 100% error-free service, a proper evaluation of customer complaints and a satisfactory service recovery are important to gain competitive advantage. Organization should increase their connections with the customers got dissatisfied to determine the sources of dissatisfaction. They should establish effective service recovery mechanisms to reduce negative outcomes. Organizations must identify potential service pitfalls at the initial stage and must design remedies before service failures create higher negative feedbacks from customers. The impact of several organizational activities and decisions, employee attitudes and behaviors, quality of products and services towards CRM, customer satisfaction, loyalty, feedback and complaining behavior of the production and after sales of automobiles were investigated within the research.



Fig. 2. Loyalty Relationship (Salegna and Fazel, 2011)

### III. RESEARCH METHODOLOGY

A. The CRM process of the organization operates through the coordination of four divisions, which are Sales and Marketing, Production and Assembly, Customer Care, and After Sales Services. In order to fulfil the practical gap caused to increase the number of complaints, the research was conducted in the form of a case study by considering the factors like satisfaction, loyalty, feedback, complaining behavior and defensive marketing strategy.

#### Research Question

“What is the impact of Customer Relationship Management towards customer satisfaction?”

#### Research Objectives

- To determine the drawbacks of the CRM process and the factors which cause an increase in customer dissatisfaction and complaining behavior
- To assess the impacts of customer dissatisfaction and complaining behavior to the organization
- To identify the factors that highly impact on the customer satisfaction and loyalty
- To identify the organizational areas that need to be improved for a higher level of customer satisfaction

#### Data Collection

Both primary and secondary research methodologies were used to collect data. Semi Structured interviews were conducted with three responsible personnel of the organization in order to have an insight to the research question from different perspectives. A self-administrated questionnaire forms were distributed to a sample of 50 customers among 230 who visited the organization within 3 days. Organizational corporate website, management reports, customer feedback forms and the letters sent by several customers were analysed to collect secondary data to strengthen research findings.

#### B. Data Analysis

Qualitative data gathered from interviews and documentary analysis was interpreted in a summarized manner by organizing them around the key themes identified from the review of literature. Quantitative data gathered from questionnaires and organizational reports was analyzed and interpreted in the forms of tables, charts and percentages.

### C. Research Limitations

The number of interviews conducted was restricted due to time constraints, limited resources and accessibility. With the busy and tight work schedule of organisational personnel it was extremely difficult to contact them and make appointments for the interviews. Lack of interest and motivation of participants in taking part in interviews and questionnaires was another research limitation. Accessibility of secondary data sources was limitations due to some organizational rules and regulations. It was difficult to access a secondary research material relates to the research question on the same site.

## IV. RESEARCH FINDINGS

The demand for cars and SUVs were higher than the other vehicle categories, and the number of customers who purchased the first vehicle in their life was 62% among the consumer base. According to the analysis across customer demand and interest, the appearance of vehicles (attractive design & body style) and its comparative low prices (low cost) influenced in attracting more than 74% of its customers. The overall customer satisfaction with vehicles, services and the organization was 80% while 1/10 customers were highly dissatisfied towards the organization due to various circumstances. Overall customer satisfaction with the quality and comfort of vehicles was 62%, while 20% of customers were dissatisfied across the quality of vehicles and services. SUV customers were highly satisfied and the car and van users were highly dissatisfied. 22% of customers had to repair their vehicles several times within the warranty period, which made them disappointed with vehicles.

34% of customers expressed their dissatisfaction with the shortage of spare parts in the company stock at the right time and their high prices, since they heavily depend on company due to the limited accessibility of matching spare parts in the local market. Customer trust on the organization was decreasing due to the incompatibility of organizational statements regarding the availability of spare parts and their prices. 28% of customers stated that the maintenance cost of their vehicles was higher and some were dissatisfied on the cost of services and repairs. Even though the customers were assured to receive their vehicle within 3 month after placing the order, research findings illustrated that only 8% of customers received their vehicles within the expected duration. According to Fig. 3, 72% of vehicles were delivered after 6 months of the order placement. Questionnaire feedback analysis emphasized that 82% of customers were dissatisfied with the time taken to deliver their vehicles. 2.4% vehicle orders got cancelled among the monthly customer orders due to the delay in vehicle delivery. As per Fig. 4, only 94% of the remaining orders could take in to the corresponding production line and 6% got delay to manufacture.

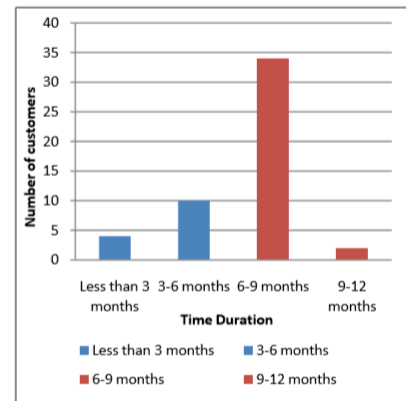


Fig. 3. Time taken to deliver vehicles to customers

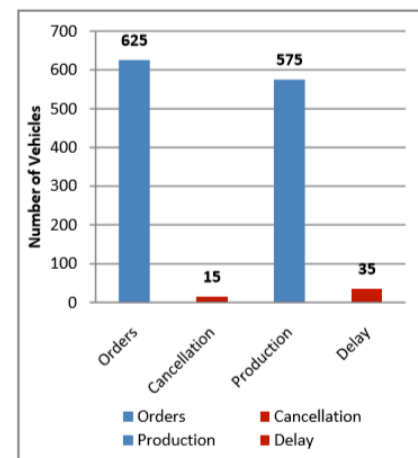


Fig. 4. Average monthly sales vs. production

38% of customers were extremely satisfied with the entire organizational process and engaged in satisfactory comments regarding the organization and its employees while willing to recommend the organization, its vehicles and services to other. Many dissatisfied customers expressed their negative commitment on the customer complaint handling process and the service recovery of the organization. 56% of dissatisfied customers remained loyal and expected changes in the organizational process. 27% of customers were highly dissatisfied and made complaints on different issues while refraining from recommendations to others. Analysis emphasized that most of the dissatisfied complaining customers required an immediate service recovery than exit from the organization. The harmful effect towards the brand image and the goodwill of the organization was identified due to some rigid actions taken by several disloyal customers like product rejections, request for refunds and the involvement of legal actions based on consumer affairs authority act.

## V. CONCLUSION

The study primarily emphasizes that the quality of products, services and the service recovery extremely impact on customer satisfaction. Secondly, it emphasizes the importance of maintaining customer trust since it has a major influence on brand image and the level of customer satisfaction. The significance of speedy responds to customer requirements, expectation and feedbacks is another main implication of the research. Finally, the study emphasizes the relationship between the competence of employees and customer satisfaction since high competence increases organizational productivity and efficiency while increasing customer satisfaction and loyalty. In conclusion, this dissertation emphasizes that the organizations should establish efficient CRM and complaint handling processes to gain competitive advantage by satisfying their valuable customers.

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# Testing An Alternative Structural Model in Community Support for Sustainable Tourism Development in Sri Lanka

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**Abstract—** Tourism is one of the largest and fastest growing industries in the world and also in Sri Lanka. It is observed as a very important means of benefit to local communities. When examining residents' support for sustainable tourism development, community empowerment plays a major role since to achieve sustainable tourism development, community leaders and developers need to view tourism as a "community industry" that enables residents to be actively involved in determining and planning future tourism development with the overall goal of improving residents' quality of life (Franzoni, 2015). The community support models are widely tested using Social Exchange Theory (SET) over the years. However the basic assumption in SET is that power vested upon people is unidimensional whereas power is multidimensional as suggested by Scheyvens (1999). Hence this study extend the existing residents' support models in the literature by testing the empowerment scales suggested by Scheyvens (1999) using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) through AMOS. The results revealed that the empowerment scales in tourism are valid and community empowerment plays an important role in gaining community support for sustainable tourism development.

**Keywords—** community empowerment, community support, sustainable development

## I. INTRODUCTION

Tourism development is a double-edged sword for local communities and attitude directly affects the current and future tourism development (Hanafiah *et al.* 2013). It results several social and economic benefits as well as costs affecting the lives of the host community. The success of the industry is depend on the active support of the local residents hence it is important for the tourism planners to plan the development of the industry (Nunkoo & Ramkissoon, 2011). Hence numerous studies has been studied the residents' attitude towards tourism development and majority is atheoretical in nature (Gursoy & Rutherford, 2004). The studies which has used a theoretical framework has most widely recognized Social Exchange Theory (SET) which implies that the residents' support is based on their evaluation on cost and benefits resulting from the industry (Nunkoo & Ramkissoon, 2011, Nunkoo *et al.* 2010, Sharply 2006, Nunkoo & So, 2015).

Scholars have conceptualized SET in various ways with different determinates to study the community support for tourism. Community attachment, economic gain, utilization of tourism resource base, the environmental attitude which has later categorized into two by aggregating the benefits and costs to a new model (Gursoy & Rutherford, 2004) which segregated the impacts into benefits and costs and

investigated their effects on support. This incorporated model incorporated two new determinants of attitudes: the state of the local economy and community concern. Gursoy and Rutherford (2004) further expanded on the above models and delineated the impacts into five categories: economic benefits; social benefits; social costs; cultural benefits; and cultural costs. More recently, Gursoy *et al.* (2009) further built upon the model developed by Gursoy and Rutherford (2004) and proposed that the perceived economic, social, and cultural benefits, the perceived social, socio economic costs and state of the local economy are determinants of residents' support for mass and alternative forms of tourism. This shows that SET does not involve a single conceptual model which sometimes leading to conflicting theoretical propositions among studies (Nunkoo & So, 2015). Nunkoo and So (2015) explained this by quoting Emerson (1976, p.335) as "SET contains sparks of controversy".

## II. LITERATURE REVIEW

The residents' support for tourism is a heavily research area where hundreds of scholars have investigated community perceptions and its relationship with residents' support for tourism. Nunkoo and So (2015) has made significant contributions to research on residents' support for tourism by developing a baseline model and comparing it with four competing models. As they argue Social exchange theory (SET) has been the most widely used theory to investigate residents' support for tourism from 1992 to date but many studies have conceptualized social exchanges in various ways by using different variables, reflecting one or more dimensions of SET. And there are some limitations of this as well.

Since the existing studies informed by SET are based on conflicting, yet theoretically sound, research propositions and leading to confusion among tourism scholars Nunkoo and So (2015) developed a baseline model of residents' support for tourism and compare it with four competing nested models using structural equation modeling. That method facilitated in uncovering new relationships among variables and was useful for development of theory. The study has further uncovered that residents' trust and their level of power to be intimately connected to their quality of life and their perceptions of tourism impacts.

As explained by Nunkoo and So (2015) in their baseline model the concept of power (PW) that exists in a set of specific relationships is central to SET, where actors are positioned within this network of power relations. As explained by Ap (1992, p. 679) "power is usually viewed as the capacity to attain ends" hence it adversely influences



residents' perceptions of tourism development, while positive reactions from residents are associated with a high level of power. Hence here they argue that power is a unidimensional construct and found that residents' trust in government and their level of power in tourism development as the two strongest determinants of quality of life. However in the limitations of their study they also states that "Thus, future studies should consider the multidimensional nature of these variables to further clarify the theoretical relationships tested in this study" (Nunkoo and So, 2015, p.12).

This shows that power is an important predictor of SET but still some controversy can be seen in the operationalization of power as a unidimensional construct. Hence Nunkoo and So (2015) suggest that empowering local residents in tourism is another effective strategy for fostering positive attitudes and improving quality of life and Education and training of local residents to work in the tourism sector are other important sources of local empowerment. This shows that empowerment can play a major role in residents' support in tourism literature.

Scheyvens (1999) has developed an empowerment framework and identified the unidimensional aspect of power in tourism which provide a mechanism with which the effectiveness of tourism initiatives, in terms of their impacts on local communities, can be determined. The framework has utilized Four levels of empowerment: psychological, social and political, as based on Friedmann's writing (Friedmann, 1992) and economic empowerment. This framework emphasize the importance of local communities having some control over, and sharing in the benefits of, eco-friendly tourism initiatives in their area and could be applied in both western and developing country contexts but, because it takes as its central concern the concept of empowerment, it is perhaps particularly pertinent when examining the extent to which indigenous people, or other disadvantaged groups, are benefiting from eco-friendly tourism.

While the rhetoric is compelling, only a handful of tourism studies have gone beyond the focus on community participation to specifically concentrate on empowerment in sustainable tourism (Cole, 2011; Scheyvens, 1999). Most recently, Cole's (2012) conceptual work discusses the importance of information and empowerment as being central to achieving sustainable tourism. This is particularly useful for the current study because it provides detailed descriptions of what empowerment should look like within sustainable tourism development. To deepen this discussion, Scheyven's (1999) descriptions of psychological, social, and political empowerment are reviewed below.

#### A. Social Empowerment

Social empowerment, within a tourism context, ensues when one perceives tourism as increasing his or her connection to the community. Scheyvens (1999) describes social empowerment in terms of enhanced community equilibrium, with residents feeling more connected and

beginning to work together. This understanding of social empowerment highlights the parent literature's focus on individuals having access to social organizations that help maintain the local quality of life and individuals working together in an organized fashion to improve their collective lives. The negative social impacts of tourism recognized by Stronza and Gordillo (2008) in the Peruvian, Ecuadorian, and Bolivian Amazon are in stark contrast to these positive descriptions of social empowerment. These include the erosion of cooperation within the community, the unequal treatment of community members from tourism development, and some community members 'buying' themselves out of traditional community obligations.

#### B. Psychological empowerment

A local community which is optimistic about the future, has faith in the abilities of its residents, is relatively self-reliant and demonstrates pride in traditions and culture can be said to be psychologically powerful (Scheyvens, 1999). In many small-scale, unindustrialized societies, preservation of tradition is extremely important in terms of maintaining a group's sense of self-esteem and well-being. Boley & McGehee, (2014) explain that psychological empowerment helps communities reevaluate the worth of their culture, natural resources, and traditional knowledge. They further explained it that this revaluation of the community leads to an increase in self-esteem and pride which has a positive influence on resident perceptions of tourism.

#### C. Political empowerment

Political empowerment, within a tourism context, speaks to residents having agency or control over the direction of tourism development within their community (Scheyvens, 1999). It is the dimension of empowerment that most closely resembles the overarching notion of residents gaining mastery of their affairs. More concretely, political empowerment necessitates residents having a voice in the tourism planning process and being able to share their concerns over tourism development. It is similar to community participation, but represents the highest rung of ladders of community participation because the attention is shifting away from mere inclusion of residents to residents having control over the tourism planning process. As with the other dimensions of empowerment, resident perceptions of political empowerment were found to have significant relationships with how they perceived the positive and negative impacts of tourism (Boley *et al.*, 2015).

### III. RESEARCH METHOD

#### A. Study area and sample

In order to examine the role of empowerment plays in sustainable tourism development this study was conducted in Sri Lanka considering the residents in Kandalama which is located in the northeastern side of the Dambulla in Sri Lanka. The hotel Heritance Kandalama is a well-known and successful hotel in Sri Lanka, which promote eco-friendly tourism with its sustainable architecture that is not to harm the natural environment however built in the midst of huge resistance from community leaders, villagers and several other pressure groups. 22 years back, this small tourism city had become a focal attention among the community of Sri Lanka when the local community of this area and several pressure groups were organizing huge protests against the construction of the Hotel Kandalama. Today the hotel is practicing many projects to empower communities and it is

awarded many local and international awards to their eco-friendly practices and CSR activities.

The population studied was residents, those who owned a home, including permanent and seasonal residents, were selected as the unit of analysis. Residents, who may or may not own a home, might have been an alternative sample, but these lists are often unavailable and not regularly updated. A homeowner list was obtained from Grama Sevaka officer of Kandalama village. There are 463 families in Kandalama village and the sample of 202 households. A quantitative approach was taken with 200 residents in Kandalama village who live 20km radius from hotel the closest village to Heritage Kandalama hotel. A door-to-door, pen and paper questionnaire using a systematic random sampling scheme commonly used within resident attitude research and this type of sampling scheme was chosen based upon its ability to best garner a representative sample of community residents, increase response rates, and include minority groups that may be left out from other sampling methods (Boely et al, 2015). Every 2nd household on the right side of the road was chosen to be surveyed until 202 usable questionnaires been completed. It is suggested that a minimum sample size of around 200 respondents is necessary to ensure effective use of Structural Equation Modeling (SEM) analysis. However, a sample size beyond 400 is also likely to be problematic as it may generate poor goodness-of-fit-indices (Anderson and Gerbing, 1988).

#### B. Method of Data collection

The questionnaire was developed from a review of existing literature dealing with residents' attitudes toward tourism development and was modified based on feedback received from several county officials and tourism professionals. The questionnaires were administered using a direct face-to face survey methodology because of the strength of this method in achieving high response rates. In total, 202 usable questionnaires were collected. The variables include a series of attitude items based on previous work by Gursay and Rutherford (2004); Hanafiah et al. (2013); Nunkoo and Ramkissoon (2010, 2011, 2012) and Nunkoo and So (2015) and tested as mediating variables: positive (10 items) and negative impact of tourism (10 items), support for tourism (6 items) which was the ultimate dependent variable. A Likert-type scale where 1 equaled strongly disagree and 5 equaled strongly agree was used for each attitudinal item (Maddox 1985). Independent variables included direct economic benefits from tourism (2 items); community empowerment measured using three dimensions, psychological (4 items), social (3 items) and political (3 items) and were based on work by Boley and McGehee (2014); Boley and Woosnam (2015).

#### C. Data Analysis

Ten of the 14 hypotheses tested were supported by the SEM model. The table I summarizes the Hypothesized relationships between constructs and observed relationship from the SEM.

When testing a model like the one presented previously, both the validity of the measures as well as the structural relationships between the constructs needed to be tested. These two tests (CFA and SEM) were performed using AMOS's Full Information Maximum Likelihood Estimation (FIML) within the Statistical Package for the Social

Science's (SPSS.) FIML was chosen because of its availability within AMOS/SPSS, ease of use, and its superb ability to estimate missing data values.

There were three Hypotheses focused on testing the influence of direct Economic Benefit from eco-friendly tourism within the model. "There is a negative relationship between direct economic benefits from eco-friendly tourism and perceived negative impact from eco-friendly tourism" ( $b = 0.04$ ;  $p = .922$ ) and "There is a positive relationship between direct economic benefits from eco-friendly tourism and residents' support for eco-friendly tourism" were not supported by the study ( $b = -0.47$ ;  $p = .40$ ). However, "There is a positive relationship between direct economic benefits from eco-friendly tourism and perceived positive impact from eco-friendly tourism" was supported by the study ( $b = 0.286$ ;  $p = 0.000$ ). This suggests that one's perception of economically benefiting from tourism had a greater influence over their positive or negative perception of tourism's impacts within the community than their support for tourism.

#### HYPOTHESIS TESTED

	Hypothesis			Supported
		Regression weight	P	
H1	There is a positive relationship between direct economic benefits and residents' perceived positive impact of tourism	0.286**	0.000	Y
H2	Perceived social empowerment has a positive relationship with residents' perceived positive impact of tourism	-0.159*	0.003	N
H3	Perceived political empowerment has a positive relationship with residents' perceived positive impact of tourism	-0.57**	0.000	N
H4	Perceived psychological empowerment has a positive relationship with residents' perceived positive impact of tourism	0.06	0.916	N
H5	There is a negative relationship between direct economic benefits and residents' perceived negative impact of tourism	0.004	0.922	N
H6	Perceived social empowerment has a negative relationship with residents' perceived negative impact of tourism	0.291**	0.000	N
H7	Perceived political empowerment has a negative relationship with residents' perceived negative impact of tourism	0.492**	0.000	N
H8	Perceived psychological empowerment has a negative relationship with residents' perceived negative impact of tourism	-0.13	0.087	N
H9	There is a positive relationship between direct economic benefits and residents' support for tourism	-0.47	0.4	N
H10	There is a positive relationship between perceived positive attitude for tourism and residents' support for tourism	0.179*	0.008	Y

	Hypothesis		Regression weight s	P	Supported
H11	There is a negative relationship between perceived negative attitude for tourism and residents' support for tourism	0.415**	0.000	N	
H12	Perceived psychological empowerment has a positive relationship with residents' support for tourism	0.44**	0.000	Y	
H13	Perceived social empowerment has a positive relationship with residents' support for eco-tourism	0.053	0.59	N	
H14	Perceived political empowerment has a positive relationship with residents' support for eco-friendly tourism	0.011	0.899	N	

Three hypotheses (H4, H8, H12) which tested the relationship between psychological empowerment and the perceptions of the positive and negative attitudes of tourism and overall support for tourism. Two of these hypotheses (Hypothesis 4 “Perceived psychological empowerment has a positive relationship with perceived positive impact from tourism”  $b = 0.06$ ;  $p = 0.916$ ; Hypothesis 8 “Perceived psychological empowerment has a negative relationship with perceived negative impact from tourism”  $b = -0.13$ ;  $p = 0.087$ ) were rejected in the study. However; Hypothesis 12 “Perceived psychological empowerment has a positive relationship with overall support for tourism”  $b = 0.044$ ;  $p < 0.001$ ) were support by the study. This suggests that tourism which builds up resident pride and self-esteem significantly influences how residents support for tourism within the community over their attitude towards tourism.

Hypotheses 2, 6 and 13 tested the relationship between social empowerment and the perceptions of the positive and negative impact of tourism and overall support for tourism. Hypothesis 2 “Perceived social empowerment has a positive relationship with perceived positive attitudes from tourism” ( $b = -0.159$ ,  $p = 0.003$ ) and Hypothesis 6 “Perceived social empowerment has a negative relationship with perceived negative impact from tourism” ( $b = 0.291$ ;  $p = 0.000$ ) were both significant but not the expected sign reported hence not supported by the study. However, Hypothesis 13 “Perceived social empowerment has a positive relationship with overall support for tourism” ( $b = 0.053$ ,  $p = 0.59$ ) was also not supported by the study. These findings suggest that social empowerment's do not influence perceptions of tourism's positive and negative impact within the community and their support for tourism. However it should be noted that when the impact of tourism constructs are removed from the model, social empowerments influence on support for tourism becomes positive and significant suggesting that social empowerment's relationship with support for tourism may be mediated through how residents perceive the impacts of tourism within the community

Hypotheses 3, 7 and 14 tested the relationship between political empowerment and the perceptions of the positive and negative attitudes of tourism and overall support for tourism. Both Hypothesis 3 “Perceived political empowerment has a positive relationship with perceived

positive impact from tourism” ( $b = -0.57$ ,  $p = 0.000$ ) and Hypothesis 7 “Perceived political empowerment has a negative relationship with perceived negative impact from tourism” ( $b = 0.497$ ;  $p = 0.000$ ) were both significant but not the expected sign reported hence not supported by the study. Further, Hypothesis 14 “Perceived political empowerment has a positive relationship with overall support for tourism” ( $b = 0.011$ ,  $p = 0.899$ ) was also not supported by the study. The finding that political empowerment did not directly influence support for tourism was unexpected and may be a factor of the low levels of perceived negative attitude within the community (Mean = 2.7). It is suggested that these empowerment's relationship with support for tourism should be further tested in a wider spectrum of communities to see if these findings persists.

According to the above hypothesis testing it is clear that empowerment has a significant contribution to the residents' support in the eco-friendly tourism resort development which has to be further tested to verify the model further. However to conclude the contribution of community to eco-friendly tourism resort development the model R squared should be calculated.

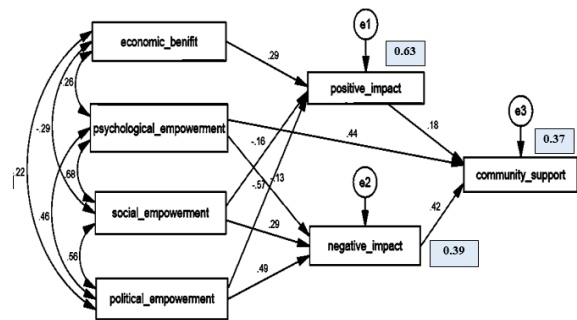


Fig. 5. The conceptual model tested

The figure I shows the squared multiple correlations of the model which indicate the total variance explained by each exogenous variable. According to the total variance explained the residents' support explain the total variance of 37%, perceived positive attitude for eco-friendly tourism 63%, and negative attitude for eco-friendly tourism 39% . These values explain the contribution of each variable to the model as total variance explained.

#### IV. CONCLUSION

The study's findings that there are both formal and substantive constructs influencing resident attitudes provides additional support for theoretical perspectives that embrace the view that residents' attitudes are more than a function of the economic benefits associated with tourism, but include substantive factors such as empowerment. It is identified that direct economic benefit of tourism will not completely change their support for the development but their attitude play an important role in their perceived support for the resort development. Results from the study also illuminate the long held relationship between the construct of Personal Economic Benefit from eco-friendly tourism and Support for Tourism. This indicates the continued importance of examining resident perceptions of economically benefiting

from tourism. While those employed in the tourism industry clearly see the direct personal economic benefits from tourism, those not employed in tourism may have a harder time seeing that they actually benefit. One recommendation based upon these findings would be to publish and promote the indirect personal economic benefits of tourism, including tax burden relief and the services subsidized by tourism income.

Further it has identified that psychological empowerment has direct influence on residents' support and therefore inclusion of empowerment has a significant impact on the residents' support model. These findings also highlight the importance of those with the responsibility of developing tourism to empower residents psychologically, socially, and politically; first, in order, to gain their psychological empowerment to support for tourism.

Mainly when the local people feel self-esteem and proud have a direct impact to their support for the tourism development. If managers are interested in fostering psychological empowerment among their residents, consideration should be given to marketing strategies that highlight the special features of the region from a local's perspective. If those responsible for developing tourism are able to simultaneously increase resident attitudes towards tourism while enhancing destination competitiveness through marketing initiatives grounded in resident empowerment, then resident empowerment can be a win-win sustainable development strategy for destinations. When the community feel proud and know how unique their community is will contribute positively to the development of the industry.

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# The Empirical Study on Talent Identification Strategies and its effect on Performance of the Public Sector Organizations in Sri Lanka

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**Abstract—** The cornerstone of an organizational performance is identification of high potential talent in the hyper-competitive and increasingly complex global economy. Hence, Organizations exploit diverse strategies for identification of talented people. This article move forward theory of talent identification strategies (TIS) through the practical implication of public sector organizations in Sri Lanka. The principal duet of talent identification strategies (TIS) was hypothesized: Interior talent identification strategies (ITIS) and Exterior talent Identification Strategies (ETIS). The foremost intention of this study is to discern the impact of talent identification strategies on public sector performance in Sri Lanka. The questionnaire survey was conducted for 180 HR professionals in the public sector organizations in Sri Lanka. In order to analyze data, Kolmogorov-Smirnov test was employed to test for its normality, and Pearson correlation test was used for measuring the relationship between variables and also regression analysis was applied for determining the effect of variables. The results indicate that talent identification strategies are not significant predictors of performance in public sector companies. Internal alignment between talent management strategies and Business Strategy are suggested for future research as crucial to trump organizational performance.

**Keywords—** talent management, talent identification strategies, interior talent identification strategies, exterior talent identification strategies, organizational performance

## I. INTRODUCTION

Since, talent pool has become powerful source of competitive advantage and sustainability, business world face enormous competition in finding talented people to the organization [28]. It is vital for the organization to take a proactive role in identifying and cultivating their workforce who have capabilities and potentials.

Talent management (TM) is a strategic approach to identifying talents to meet expected level of performance in the company by facing global challengers effectively. The initial and key function of talent management process is the recognition of knowledgeable and skilled individuals of the organization. Furthermore, Anwar, A., Nisar, Q. A., Khan, N. Z., & Sana, A. [3] identified that TIS are the most crucial fundamentals of talent management process. Even though an organization fails to identify its talented individuals, it will have given little value to the right positioning and right development opportunities for the individuals in order to achieve the overall objective of the business [28].

Sri Lankan business community has been mainly divided in to two sectors; (1) public sector and (2) private sector based on numerous crucial factors such as, ownership, operations, goals& objectives and so on [2]. Public sector organizations form the backbone of Sri Lankan economy constituting to provide services to the public. In which main services health, education and security are provided under the free basis and other services such as transport, agriculture, insurance, bank, etc. are provided at a lower rate which compares to the private sector [24]. While most of these organizations provide services, few of them are earning profits, which belong to the semi government organizations. They also employ a majority of the working population with high job security. As a developing country, public sector has been playing a crucial part in economic, social and cultural development in Sri Lanka. Thus, the wellbeing of this vital sector is very important to up keep the wellbeing of the overall development of the country. However, this sector does not seem to be dynamic and performing well in achieving their expected goals which compares to the private sector and also public-sector organizations of other countries such as China, Singapore and Malaysia in Asian region. Many organizations seem to have lack of efficiency and effectiveness. Most of the organizations are highly influenced by the political parties of the country. The policies and procedures have changed based on the political agenda. New technological innovations and adaptations are lacking behind. Hence, existing employees are dissatisfied due to inadequacy of proper strategies to overcome these obstacles. Numerous HR professionals and practitioners stated that organizational performance heavily depends on employees' performance no matter size, nature or the ownership of the business [24]. As some experts of this sector argued, one of the main reasons for the high rate of inefficiency is due to its lack of attention on the talent management strategies in their organizations. In which talent identification strategies (TIS) are crucial. Hence, the broad objective of this study is to examine effect of talent identification strategies (TIS) on performance of public sector in Si Lanka.

## II. TALENT MANAGEMENT (TM)

TM means a systematic and bundle of HR policies and practices (planning, forecasting, identifying, attracting, selecting, hiring, rewarding, retaining, reducing and

removing, training and developing, and evaluating) which relates to the managing and utilizing of human talents in order to congregate the local and global business challengers of the company [36]. Similar definition stated by Scullion et al. [40]: TM involves attracting, selecting, developing and retaining the best employees to achieve organizational strategic priorities. TM refers to set of HRM activities of business to manage their talented people to play differentiated role in order to meet global challengers [40]. The three definitions have similar features that they identified TM as a mechanism of identifying, developing and retaining talents. Furthermore, TM is strategically essential for the company not only in managing talents, but also for managing expansion, downsizing and structural alignment of the firm [20]. TM scholars have paid more attention on strategic integration of TM [13]. Since, three talent management strategies: talent identification, talent developing and talent retention were identified. For the talent identification, use various mechanisms and are explained by the TM scholars [40]. After identification of talented individuals to the organization, development and retentions of them are the responsibility of human resource manager with the support of other managers of the company. Since this study stresses on talent identification strategies (TIS) on organizational performance (OP) in PUSO in Sri Lanka, following section emphasizes talent identification strategies, mainly interior talent identification strategies and exterior talent identification strategies.

### III. TALENT IDENTIFICATION STRATEGIES (TIS)

Human resource professionals and practitioners understood that talent identification is most challenging task of the organization [16], [33]. Organizations exploit different strategies to identify talented people since; they are the investment of the organization towards organizational success.

Tansley et al. [38] stated that, identifying talented individuals of the organization is a responsibility of a talent review panel which consists of the head of human resource management, representatives of senior management, line management and individuals who have specific expertise in the particular area. However, identifying talents are not always based on the judgment of talent review panel as different organizations employ different kind of strategies for identifying talents [9].

Identifying talent strategies basically can be divided into two categories: internally and externally. Identifying talent strategies internally may include competence/skill inventory, performance appraisal and human resource planning. However, selection of identifying talent strategies is based on HR management philosophy on its effectiveness [4]. In line with the above study Stahl et al., [36]. study is prominent, it investigates how leading multinational companies build and sustain their talent pipeline sampling 37 global companies; based on the finding of the study, the practice of "leadership competence models" is the most

significant model of talent management. Leadership competence models refers to a set of knowledge, skills, competencies, traits and behaviours that a organization is willing to perceive, build up and sustain among their existing staff that have high potential. On the basis of research findings, Stahl et al. summarized the best practices in the area of recruitment and staffing as follows: establishing a strategy for making a talent pool, building a relationship with leading institutes and universities to find talent, maintaining proper hiring strategies, careful consideration of employee positioning and employee branding, adopting an organizational culture, conducting a performance assessment, as well as maintaining competence profile for leadership talent succession planning and different talent pool.

About the identification of talent strategies in a Sri Lankan context, Dharmasiri [18], Karunathilaka [22] explained six B's. It was originally introduced by Ulrich and Brockbank (2005) and Dharmasiri [18] and Karunathilaka [22] explicated its Sri Lankan aspect. The six B's refer to six talent management strategies: buying, building, borrowing, bouncing, binding and boosting. Under the identification of talent strategies, buying strategy involves the aspect of talent acquisition. The talent acquisition strategies include: referral hiring, building a web based hiring and aiming towards potential employees to be used by the organizations. In the Sri Lankan private sector, organizations practice more innovative recruitment strategies instead of traditional methods. However, public sector organizations are lacking behind in innovative strategies. The recruitment and hiring processes are strict with the public policy framework and it cannot go beyond the scheme of recruitment (SOR) which is implemented by public policy makers. That is being said, borrowing strategy also lines up with talent identification which refers to acquisition of talent on a contract basis. There are several borrowing strategies introduced by Dharmasiri [18]: outsourcing of work, forming of joint alliance, retaining consultants, maintaining relationships with former employees and visiting benchmark sites. In Sri Lanka both public and private sector organizations use this strategy and some human resource manager is converted into an outsourcing manager. However, due to the trade union pressure, several outdated labours and the nature of the functions performed by the organizations are considered as obstacles towards practicing of borrowed strategy. Kermally [25] argued that, as a market place becomes more complex and dynamic, and when an organization meets global market, it requires talented people to execute the market's needs.

However, several researchers illustrated that it becomes increasingly hard to acquire and retain suitable talent for local and international operations of business ([20], [13], [21], [36]). The identification of high-potential talents are progressively becoming a severe crisis for most of the local and global organizations [7] and [10]. On the other hand,

Kermaly [25] said that even though organizations still practice the concept of redundancies, appropriate talents are at a comparatively lower level. As per the finding of Douglas et al. [20] large number of organizations still get great effort to fill up talent shortage in higher level of talents. Thus, appropriate talent identification is also a key issue of any organization. Present study encompasses with both interior and exterior talent identification strategies in which dimensions of interior strategies are skill inventory, skill audit, performance appraisal and exterior strategies' are tested through different selection methods.

#### IV. ORGANIZATIONAL PERFORMANCE (OP)

Many authors Organizational performance (OP) comprises of the actual output or goals of an organization as considered against its expected outputs or goals. Since organizational performance is a multidimensional conception, organizations rely on multiple measures of performance when reckoning the success or failure of the organizations [33]. Richard et al. [32]. argued that OP comprises mainly three determinants. Such as financial performance, product market performance and shareholders return. Moreover author explicated the measurement criteria of each determinants of OP: the financial performance involves profits, return on investment, return on assets and etc., product market performance involves sales and market share. The shareholder return involves total shareholder return and economic value added. Organizational performance (OP) plays premier role both in management and human resource management disciplines. Experts of the above disciplines are fascinated with organizational performance including strategic planners, finance, legal, operations and organizational development. In recent years, many organizations have attempted to manage organizational performance using the different methodology where performance is tracked and measured in multiple dimensions.

The performance of the public sector in Sri Lanka is not at the expected level. On the report of World Bank (2017), Sri Lanka ranks 111 among 190 countries in the "ease of doing business" index. For the time being, according to the Transparency International, Sri Lanka ranks 91 out of 180 countries in terms of corruption perception. Inferior governance and ineffective rules and regulations have caused economic growth in Sri Lanka to slow down [39]. Nevertheless, the public sector must perform its role effectively for the engine of economic growth in Sri Lanka to function well. As a labour intensive country, Sri Lanka has sufficient strength of talented labour (censes, 2016) in order to capitalize them and reap the high level of performance [17].

#### V. THEORETICAL FRAME WORK AND STATEMENT OF HYPOTHESES

The primary objective of this study is to identify the effect of talent identification strategies on public sector performance in Sri Lanka. As stated in the literature survey, it authenticated that TIS and OP have positive relationship. Nevertheless, TM is as an emerging field of HRM, strenuous to find local researches. Thus, a research frame work is designed by taking into consideration of impact of main variables.

Thus, three variables are identified in the research frame work: talent identification strategies as independent variables and organizational performance as a dependent variable. Talent identification strategies comprise with two variables: Interior talent identification strategies (ITIS), Exterior talent Identification Strategies (ETIS). Based on the theoretical frame work, three hypotheses are developed. Such as, H1: Talent identification strategies have positive impact on organizational performance.H2: Interior talent identification strategies have positive impact on organizational performance.H3: Exterior talent Identification Strategies have positive impact on organizational performance.

#### VI. RESEARCH METHOD

To examine the aforesaid hypotheses, a questionnaire survey was carried out among the HR professionals of public sector organizations in Sri Lanka. This instrument comprises of three sections. First it assesses demographic profile of the respondents (Table 2) and Secondly TIS. TIS involves of two components: Interior talent identification strategies, Exterior talent Identification Strategies. Thirdly it measures organizational performance (OP). And it was designed using a Likert five scale models with the options from strongly agree to strongly disagree. Each option was scaled: 5= strongly agree; 4= agree; 3= neutral; 2= disagree and 1= strongly disagree.

The questionnaire survey was organized from 23/11/2017 to 16/05/2018. There are 294 public sector organizations that are registered under Ministry of Planning (Ministry of Planning, 2017). Since talent management strategies are almost related to the human resource management functions, respondents of this survey were human resource professionals. For the collection of data, an official cover letter that clarifies the purpose of the survey had been attached together with the questionnaires. It incorporated also with researcher's email address and mobile phone number in case there were further clarifications about the questionnaire from the respondents. Respondents have been guaranteed of complete confidentiality and honest opinions were encouraged.

In total, 294 questionnaires were distributed by the researcher and 202 questionnaires returned. However, only180 questionnaires, equal to 61.22 per cent, were considered for data analysis. The remaining 22

questionnaires were not taken into data collection because questionnaires were not properly completed by the respondents.

## VII. ANALYSIS AND RESULTS

Data was analyzed by using the Statistical Package for Social Science (SPSS) version 21. Four statistical techniques were employed with different purposes. The validity of the questionnaire was confirmed by experts in this field of HRM, in addition to testing of reliability, Cronbach's alpha coefficient was used. To analyze data, Kolmogorov-Smirnov test was employed to test for its normality, Pearson correlation test was used for measuring the relationship between variables and regression analysis that was applied for determining the effect of variables.

### A. Reliability

For testing of reliability of the instrument, Cronbach's alpha was used and those values of three variables are [ITIS (0.897), ETIS (0.802) and OP (0.903)] more than 0.7. Further the internal consistency reliability of the measures used in this analysis can be considered as good for talent identification measures.

### B. Demographic Profile

Consistent with a male-controlled sector under research, most (60 per cent) of the participations are males. This is the nature of human resource management field in Sri Lanka. However, over the past decade contributions from female HR managers have increased dramatically. In addition to another feature of the public-sector population was introduced by this research; around 85 per cent of the HR professionals are above the age of 40 years which were considered as experienced workers. Moreover, their education levels are above the degree (around 60 per cent) and also in middle and senior level (around 95 per cent) position of the employment. At present HR managers are in top level of the organization. In demographic data on organizational side, 60 per cent of companies consist of more than 1000 employees. From the above discussion it can be concluded that the sample of this research does not deviate much from the general population of HR managers at public sector organizations. Hence, it is considered as representative of the population of interest.

### C. Descriptive Statistics and Correlation

Descriptive analysis was carried out to determine the mean scores and standard Deviations for the variables. Based on 180 valid cases being examined for two independent variables; ITIS, ETIS and one dependent variable; OP, the statistic output as shown in Table 2 was obtained. Apparently, the mean scores for all three variables are closer to 3 and OP ( $3.83 \pm 0.523$ ) is the highest and both independent variable are almost similar (ITIS:  $2.98 \pm 1.03$ , ETIS:  $2.77 \pm 1.1$ ). It means that organizational performance of the sampled organizations is high and quite similar contribution is given by ITIS and ETIS for their performance.

The result of the correlation analysis also was given in Table 2, which proved that there is a significant and weak positive correlation between talent identification strategies [IT IS:  $r=0.185$ , ETIS:  $r=0.081$ ] and organizational performance ( $r=0.138$ ) in public sector organization, which is less than 0.3. In social sciences, based on Cohen's criterion, correlation values of more than 0.3 are considered as sizable level of association [35].

### D. Hypotheses Testing

Multiple regressions were used to test H1, H2 and H3. Results are tabulated in Table 03. Based on the results, OP slightly depends on TIS (ITIS & ETIS). The R-squared value was 0.053, which means 5.3% of the variation in OP is explained by ITIS and ETIS. The p-value from the ANOVA table is less than 0.001, which means that at least one of the two variables: ITIS and ETIS can be used to model OP. The equation:  $OP = 3.563 + 0.202 (ITIS) - 0.121 (ETIS)$ . Thus, for every unit increase in ITIS, OP is expected to increase by 0.202 units provided other variable remain unchanged and for every unit increase in ETIS, OP is expected to decrease by 0.121 units provided other variable remain unchanged. P-value of only ITIS is less than 0.05. Hence, ITIS is the significant predictors of OP and ETIS is not the significant predictors of OP. Based on the standardized Beta coefficients; the effect of ITIS (0.4) and ETIS (-.254). The VIF values are less than 5. Hence, there is no problem of multicollinearity. In the residual plot, all the points are falling within  $\pm 3$  and the points are at random. The Kolmogorov-Smirnov test of normality on the residuals gives a p-value of 0.058, which is more than 0.05. It means that residuals are normally distributed and it is symmetrical. Thus, the assumption of normality of the residual terms is met. Hence, data are supported to accept the H1 and H2 only and H3 is not supported by the data.

## VIII. DISCUSSION AND IMPLICATIONS

The results of this study put forward significant insights regarding the effects of TIS (ITIS and ETIS) on OP of public sector organizations in Sri Lanka. Even though talent identification strategies are significant on public sector performance, its contribution to performance of the public sector is very low. In line with the present study, Arachige and Robertson [5] explained, selective hiring as a high-performance work practice upon financial performance of Sri Lankan organizations was not significant. Along with Abeysekara [1] stated that realistic job information also was not significant. However, numerous research findings were contradictory for the finding of the current study. Lynch and Smith [26]; Marwat, Qureshi, & Ramay [30] and Saddam & Mansor [34] stated that talent identification and selection are the preliminary stage of HRM process which helps in identifying and positioning of talented people for the relevant job in order to enhance the organizational performance. Abiud, Okiko, & Kadondi [3] and Mustapha, Ilesanmi, & Aremu [30] examined the recruitment and selection process (recruitment policy, recruitment procedures, cost constraints, time constraints, selection



techniques, and selection criteria) were significant determinants of the employee performance (effectiveness, organizational image, efficiency and innovativeness) of the micro finance institutions in Kigali. Rwanda Schuler; Jackson & Tarique [37] stated that competence based talent identification was significant with success of the IT sector in India. Similar study was done by Shirkhani & Nazari [9] for oil products company in province of Ilam and claimed that talent attraction was a significant predictor of organizational performance. Mahmood, Iqbal, & Sahu (2014) revealed that recruitment and selection practices of banking sector in Pakistan were positively associated with organizational outcome and it was also significant predictor. Rop & Kwasira (2015) to examine the impact of attraction of talent on OP in public universities in Kenya using different

indicators. Such as branding of employer, reasonable pay, work life balance and job security. However, indicators of OP: customer satisfaction and quality of service are almost similar to the non-financial indicators of present study. For the reason is Rop & Kwasira had derived the indicators based on the Maslow Theory. The final outcome of the study shows that attraction of talent has significant positive impact on OP. The study suggested that organizations can move forward their betterment through different aspect of talent attraction like employer branding and giving guaranteed of providing benefit for their existing and potential staff. This suggestion could be considered by the policy makers especially of public sector organizations in Sri Lanka to enhance their performance.

From the above discussions there are two things to address; (1) limitations of this study and (2) comments for future research. The existing literature regarding TIS in this review does not identify the variables related to the internal alignments between TIS and OP. Hence this study shows moderate association between independent and dependent variables. TIS studies used in this review are also lacking in testing of relationship between demographic variables and TIS in order to achieve the organizational success. In terms of further research, above factors can be considered and also has to remember that the time of TM is changing swiftly.

From theoretical implication perspective, the researchers in Sri Lanka can use this model for future research especially in public sector to replicate and compare this finding. Currently, there is limited research on TM in local context and this research is a sign of requirement to be understood further. The model needs to be enhanced further to understand different talent management strategies and opportunities for OP. This study also implies many essential managerial or practical implications. Averting of the inferior practices of TM, study recommend crafting a talent plan integrated with strategic plan of the organization. In this skill audit might be executed to identify the internal and external talent, talent mapping and competence framework to match the organizational requirements with talents.

Moreover, now with the Baby Boom generation is going to retire, generation Y & Z are emerging in the workig place.

As a results, new technology, social media: face book age and twitter era are embedded by new generations. Hence HR professionals have to change their traditional recruitment mehdods to innovative sourcing methods such as, recruitment workshops, re-hiring, campus reserch programs, employee referrals, on line recruitment, websites which are away from traditional advertisement methods [11]. Moreover, traditional interview methods should also be changed to role plays, presentations, assessment centers, trade test/job speciiic test, psychometric and competency profiling [17].

TABLE 1- DEMOGRAPHIC PROFILE

Variable	Frequen cy	Perce ntage (%)	Variable	Frequen cy	Percent age (%)
Gender			Diploma	78	42.7
Male	105	58.6	Other	41	23.0
Female	75	41.4	No. of Employees		
Age			< 100	25	14.0
<30	84	14.9	101-500	16	9.0
31-40	56	31.1	500-1000	31	17.1
41-50	27	46.8	> 1001	108	59.9
>51	13	7.2	Level of Employment:		
Educational Qualification			Senior	115	63.88
Post Graduate	41	23.0	Middle	65	36.11
Degree	20	11.3	Junior	0	0

The study proclaimed that intangible assets such as human talents are the most dominant assets for the organization rather than tangible assets such as capital, money, technology and material. Based on the research finding, identifying talented people effectively is crucial for organizational success and correspondingly organizational success depends on performance of the talented people and which leads to organizational sustainability and competitive advantage for the future. Hence, it is essential for human resource professionals of the company to coordinate with the top management especially in public sector organizations in Sri Lanka to address the talent management initiatives.

TABLE 02 – DESCRIPTIVE STATISTICS AND CORRELATION

Variable	Mean	SD	TIS	ITIS	ETIS	OP
TIS	2.88	1.02	1			
ITIS	2.98	1.03	.958**	1		
ETIS	2.77	1.1	.963**	.845**	1	
OP	3.83	.523	.138**	.185**	.084**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

TABLE 3 - RESULTS OF REGRESSION ANALYSIS

Model	Unstandardiz ed Coefficients		Standar dized Coeffi cients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Toleranc e	VI F
(Constant)	3.563	.110		32.311	.000		
ITIS	.202	.065	.400	3.102	.002	.287	3.49
ETIS	-.121	.061	-.254	-1.971	.050	.287	3.49

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# Descriptive Analysis of Newspaper Job Vacancy Advertisements as a Recruitment Method: In Sri Lankan Context

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**Abstract**—Recruitment is one of the remarkable functions in Human resource management due to its importance and relevance for being successful in achieving pre-desired goals via suitable and appropriate employees. Newspaper job advertisements have become popular recruitment method due to its inherent advantages compared to other recruitment methods. The survey of newspaper job vacancy advertisements as a recruitment method in Sri Lankan context attempts to verify trends of Sri Lankan newspaper job vacancy advertisements in terms of eleven newspaper job advertisement characteristics; job category, size, appearance, etc. The Sunday Observer is one of the prominent medias for job vacancy advertisement that is being used by several organizations in Sri Lanka. In that case, source of data collection for this research relied on the Sunday Observer vacancy advertisements. Through analyzing 800 newspaper advertisements during the period of 06 months in 2014, it is identified that majority of job

advertisements are reported in the field of marketing related advertisements, second highest demand found to be in accounting related jobs and next, jobs on operations management. Majority of job advertisements are neither picture oriented and nor colored advertisements. Sample statistics says, most of organizations have reluctant to reveal remuneration packages in their advertisements but they interest to publish their advertisement as open advertisement. The findings of the study is empirical significant for existing literature in Sri Lanka context while practically significant for top management, human resource managers/decision makers of corporations and general job seekers for their job related decisions.

**Keywords**— *recruitment methods, newspapers, job advertisements, analysis.*

## I. INTRODUCTION

Recruitment is process of finding and attracting suitable qualified people to apply for employment [1] Hence recruitment function deals with two major activities, Firstly, finding suitable job applicant from the job market and secondly, attracting them toward job vacancies of the organization [1]. The general purpose of recruitment is to provide an organization with pool of potentially qualified job candidates [2]. Recruitment is attempted to acquire a pool of suitably qualified job seekers, not over qualified or under qualified job seekers. And acquire this pool of candidate at lower cost [2]. Hence success of the organization heavily depends on the quality of the job seeker while quality of job applicant heavily depends on the success of the recruitment process [1].

Recruitment activities and channels can be classified in various ways [2]. One type of classification focuses on the distinction between *active and passive* recruitment. In the case of passive recruitment, organization waits until an applicant gets in touch with them, such as unsolicited applications. Today, many organizations have websites that contain information for people seeking jobs. In the case of active recruitment, employers go in search of

potential candidates [3]. They may do so by commissioning recruitment agencies to find candidates, or by searching in databases on the Internet where job seekers have posted their curricula vitae. They may also, for example, approach training and education institutes or University professors to get in touch with new graduates or students who have almost completed their studies [3].

Another classification is based on the distinction between *formal and informal* recruitment [1]. A type of formal recruitment is posting a job advertisement in a newspaper or magazine. Informal recruitment method involves the use of some intermediary between the employer and the potential employee. Unlike formal method, employer may not use any intermediation under informal method. An example of informal recruitment is using the employer's network of contacts [2]. This network could include the personal networks of the existing workforce as well as other employers, people working in the same business or employers in the vicinity. In addition, another study on recruitment methods pointed to the fact that current employees can act as "preliminary screeners", as they pass on information on job openings to particular members of their network and leave other members uninformed [4].

Like the active/passive criterion, the formal/informal criterion is a sliding scale [4].

Another research conducted on four recruitment sources and survival rates among employees of an insurance

company, a bank, and professional abstracting service found that employee referral was consistently a good recruitment source and that employment as well as newspaper ad was consistently poor recruitment sources [4].

Another research conducted on four recruitment sources and survival rates among employees of an insurance company, a bank, and professional abstracting service found that employee referral was consistently a good recruitment source and that employment as well as newspaper advertisements was consistently poor recruitment sources [5].

One of comprehensive surveys have been conducted in 1979 for Bureau of National Affairs (BNA) investigated about 14 recruitment sources with five major occupational group (clerical, plant/service, sales, professional, technical, managerial). The sample included 188 personal executives who were members of the 1979-89 panels of BNA's personal policies Forum. From the opinion of these executives, researcher found that most effective recruitment sources were newspaper advertisement, walk-ins, employee referrals, private employment agencies and search firms. Author further revealed that newspaper advertisement was effective sources for all employee groups. Walk-ins were particular good sources for office and plants/services employees, while private employee agencies are good source for recruitments on sales, professional/technical, managerial and office personnel [6].

Clearly, Miner's (1979) result conflicted with the result of some previous studies which showed that formal methods such as newspaper advertising and employment agencies were ineffective recruitment sources [6] – [9]. Her findings supported other result which showed that walk-ins were effective recruitment sources.

#### *a. Newspaper Advertisements as recruitment method*

Advertising has been considered one of the more traditional approaches to employees' recruitment [7]. To be a good advertisement, following features need to be included [1].

1. A clear indication of the relevant job vacancy
2. A brief introduction to the organization
3. A brief job description
4. A brief job specification
5. Rewards (pay, incentives and benefits)
6. Way of sending applications
7. Closing date

However, among other advertisement methods, newspaper advertisement are most commonly used media for recruitment [9]. Advertising, as recruitment method, organization publishes its job vacancy through modes such as television, radios, poster & newspaper. Sunday Observer is very popular for job vacancy advertisement [1] in Sri Lanka.

Many organizations use newspaper advertisement as recruitment method due to its advantages as recruitment method. First, newspapers provide more flexibility than do other methods of recruitment [8]. Secondly, advertiser would be able to measure the responses to newspaper advertisement more quickly than with other methods of recruitment [9]. Thirdly newspapers are the best way in reaching many people concentrated in one geographic area [10]-[12]. Finally, advertising is an excellent vehicle for corporate communication [13]. Major disadvantage of this method is the higher cost involved but it can be mitigated or off set with the benefits derived from the employee, if job seeker recruits right candidate [14]. Although recruitment ads are directed toward potential employees, other audience such as inactive job seekers, presidents, chairpersons, stockholders, competitors, and consumer may read the advertisement [15]. The aspects is that, though newspaper advertisement is a very popular for job vacancy advertisement, most recruitment advertisement for professional and managerial personal are relatively ineffective to attract the desired type of qualified applicant because most recruiter do not write/prepare that are unique and responsive to the desired applicant needs [16].

In the survey it is decided to investigate on eleven (11) aspects relevant to newspapers advertisements. Since the dearth of literature on surveys conducted on characteristics of job advertisements, it is decided to get insights of experts' opinion. Mixture of experts have used for this purpose; academic expert on human resources and industry expert on recruitment. Based on their opinion and insights following job category, experience, size of the advertisement, open or blind orientation, colorfulness, multi position/ single position, job specification and job description, remuneration, age and gender have identified as main elements of characteristics of job advertisements to survey on.

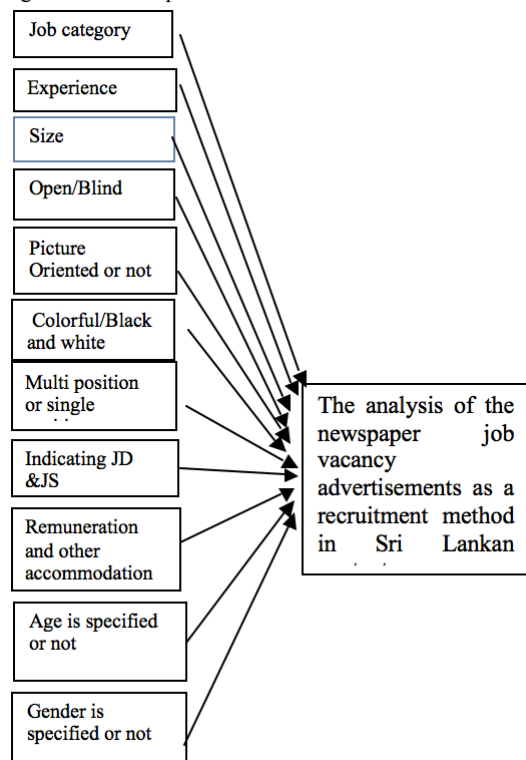
## **II. SIGNIFICANCE OF THE STUDY**

Job market is created to facilitate job providers and job seekers in fulfilling their needs. To fulfill this expectation newspaper, play vital role. Hence newspapers are still a powerful source of information. Newspaper can be denoted as a mediating factor between employer & job seeker. Another important thing is that the newspaper advertisement is one of the best recruitment source for mass recruitment around the country or region [16]. Conducting a survey based on some features of job advertisements would be empirically significant for Sri Lanka since there dearth of studies taken place in the context. Hence this study would provide vital contribution for existing literature. Apart from that practical significance of the study is should not be forgotten. In analyzing new trends in newspaper job advertising, findings of this research may provide good insights to top management of organizations in making relevant decisions of their newspaper advertising [17].

Since the research findings represent the behavior of job market of Sri Lanka, job seekers may receive guidance and knowledge in applying for positions. Degree of matches between job demanding and educational qualification [17] in Sri Lankan context can be understood by public through the research findings.

### b. Conceptual Framework

Figure 01: Conceptual Framework



Accounting, Human resources, marketing, Finance, operation management, general management and information technology have been used as job categories in the analysis. Advertisements which reveals the company name used as open advertisements while advertisements which have not revealed is considered to be blind advertisements. Request only position considered to be single position advertisements whereas more than one position is multi position advertisements. Advertisements can be designed including required qualifications for the job or job tasks and responsibilities relevant to a certain position.

## 2. POPULATION AND SAMPLE

An exploratory study will be conducted by using key jobs related advertisement appeared in the Sunday Observer newspaper for the period of 6 month of year 2014. Months are July, August, September, October, November and December. The Sunday Observer is one of the prominent media for vacancy advertisement that is being used by organizations in Sri Lanka. In that case, data

collection for this research will be relied on the Sunday Observer vacancy advertisement. Total number of 800 jobs advertisement have been collected as sample, from Sunday Observer Newspaper. All the advertisements were categorized into Marketing, HR, Finance, Accounting, General Management, IT and Operational Management for further analysis.

## III. DATA ANALYSIS AND DISCUSSION

Descriptive analysis has been taken place to analyses data by using mean, median, mode etc. Summary of the analysis is presented in this section.

Large number of jobs advertisements are presented from marketing related jobs. As percentage it is 28.1% of total advertisement sample. The next higher number of jobs advertisements is represented from accounting field which represents 26.5% of total advertisement. The next higher number of advertisements could be found in the field of Operational management which is 15.6. IT related job advertisements reported at lower level as 4% of total advertisements. Furthermore, finance and HR related jobs advertisements represent the lower level state comparing with others position. This is respectively 2.4% and 2.8% advertisement of total population.

77.2% of total advertisements are requested experience for their employment. Most of the jobs advertisements belong to less than 1/8 size advertisements, which is 37%. Next is 2/8 size advertisements that represented the 30.7% of total sample. Third, majority of advertisements used 1/4 size advertisements, which is 12% of total pool. Most of the companies interested in having small sizes of advertisements with the consideration of cost of publishing.

Most of the jobs advertisement which have been observed are *Open* Advertisement. This is 88% of total advertisement. 12% advertisements are blind advertisements. It means that most of the company trend to attract the applicant by viewing company name. In that case company should have good reputation to attract the applicant.

30.7% of advertisements are not picture oriented while majority focuses on having attractive pictures. Meanwhile, 85% of paper advertisements are black and white and not color oriented.

Advertisements vary according to the single or multiple positions advertisements. Findings say 60.3% of total advertisements are published for single positions while others are seeking for multiple positions and these organizations use multiple position advertisement to gain competitive advantage while concerning the cost of advertisements.

According to findings, 92% advertisements have been mentioned Job Description. In fact, most vital thing to be denoted in advertisements is JD. Observing the advertisements, following characteristics of applicants are requested from applicants such as experience, qualification and age rather than what applicant do on jobs (Job Specification).

92% of total population has not mentioned the remuneration package. Only 8% advertisements have mentioned relevant remuneration package for their employment. This indicates that most of employers in Sri Lanka is reluctant to reveal specific amount of cost for their job offer.

60% of job advertisements are not interested in seeking specific age limits or their jobs while 40% specifically mentioned an age limit for advertisements.

91% advertisements have not been reflected gender for their advertisements. 3.8% of requested male for their jobs and 4.8% job advertisements specified females have been for their advertisements.

#### IV. CONCLUSION

Analyzing the all jobs vacancies advertisements for the period of six months, it has been revealed that majority of job advertisements are reported in the field of marketing related advertisements. Secondly it could be found to be Accounting related jobs. Thirdly it was Operational management's jobs. Hence it can be recommended to interested parties such as school leavers, university student etc. to concern on selection of their career in fields above mentioned.

There is strong relationship between open advertisements and number of advertisements. So it is recommend to organization to use open advertisements for advertising their vacancies in order to attract most suitable applicants.

77.2% of total advertisements are requested experience for their employment. Hence it can be assumed that neglecting the position, experience is important to be mentioned for majority of jobs vacancies.

Most of the companies did not mention the duties of the jobs on their employments (54% of total advertisements). Then it will cause to be applied unqualified applicants and then indirectly it will lead to increase recruitments cost.

60% advertisements out of 800 advertisements are single position ads. It can be said that most of the companies willing to keep their advertisements in single position in order to gain advantages such as attractiveness, quality of the advertisements. On the other hands, putting several positions in one advertisement, company can gain competitive advantage of cost leadership.

According to the analysis of the relationship between relevant months and number of advertisements it could be found that November month represented higher number of jobs advertisements comparing with other months. It believes that most of the employees resigned from their employment at the end of year. As there is large number of advertisements represented in the months of November, it is indicated that most of the companies have proper Human Resource Planning system. In fact, company can gain competitive advantage through Human Resource Planning.

There is no identifiable relationship between color/picture-oriented advertisements and number of advertisements. Most probably companies do not apply the color oriented and picture-oriented advertisements for their ads considering the cost and important of the ads. As this is newspaper recruitment methods, it is not prominent factors to be applied.

According to the findings, majority of managerial advertisements have been mentioned the experience for their employment. So managerial level position should be mentioned expected experience in the view of the organization. Basically, Experience, Positions, Job description should be mentioned as a fundamental requirement of advertisements while Colure, Size, Picture orientation, Gender, Age are not essentially required to be mentioned when preparing advertisements.

In this research, few limitations can be seen. First, there is possibility of duplicate one advertisement again and again because of the reason that the company may advertise one advertisement in different angle at different time periods. In fact, it will damage to the conclusion of the research. Secondly the data may have been collected for the period of six months and the duration might not be enough to come to a proper evaluation and finally a conclusion on the topic concerned. Widening the data collection source to other newspapers in Sri Lanka would be caused in gain better results by surveying features f newspaper job advertisements.

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# HealthXStream: A Privacy Focused Doctor Meetup Solution for the General Public

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**Abstract**—“HealthXStream” is a privacy oriented, fully secure, health monitoring platform where patients and doctors get connected with each other to solve non-severe health problems. There are very few software applications in the world providing consumer grade doctor meetups through the mobile phone. Even from that few, “HealthXStream” being unique as it provides the real-time pulse rate and the temperature while providing the privacy at its peak. And it is the only health monitoring application with privacy in mind which complies to the European legislations. Doctors and the Patients are the main actors where the patients could chat with the doctor, while the pulse rate/body temperature streamed. This solution is mainly targeted to people in senility and for the people who are not preferring to move outside to meet the doctor. This will address the issue of inconvenience in accessing the doctor in a senility environment where privacy and security matters.

**Keywords**—AWS, Android, Arduino, Doctor Channeling, EU GDPR, Health Monitoring, IoT, MQTT, Privacy, Security

## I. INTRODUCTION

“HealthXStream” [see Fig. 1.] followed an innovative approach to find a solution for the busy people where they could simultaneously connect with doctors and communicate them in real-time with privacy in mind.

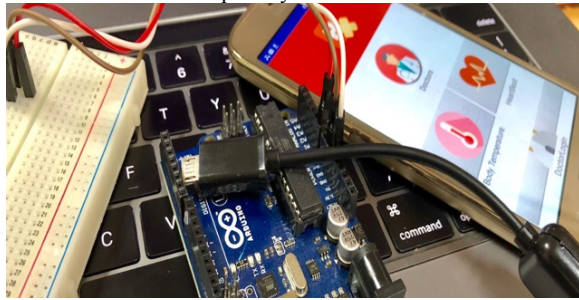


Fig. 1. Data Collection

It is a simple and user-friendly mobile health-monitoring platform for the children to elderly. It is comprised of a heart rate/pulse monitor along with a body temperature monitor where patients can send the stream directly to the preferred doctor for the diagnosis. This helps in busy environments where the patient could not physically present at the doctor in a given time. Moreover, it is comprised with the latest industry standards focused on technology, security and privacy. It is nearly impossible to hijack into the system as it follows strict security guidelines as it is using different security mechanisms such as Asymmetric and Symmetric encryption, usage of TLS1.2, and it is fully GDPR<sup>2</sup>

compliant where it becomes the first GDPR compliant Privacy Oriented Mobile Based consumer health monitoring system in the world, used AWS as the intermediary between the patient and the doctor. Have Native Android applications, which is built from the best tool available from its vendor (Android Studio – by Google Inc.).

## II. LITERATURE REVIEW

In Sri Lanka, a new commercial mobile application called “oDoc” has been introduced in 2017 [2] where the doctors and patients can meet and diagnose the patient’s illness through a video call. Basically, it can be considered as a video call service where the doctors can be participated, and the patients will pay for the consultation. “oDoc” targets niche market where the patients have a busy lifestyle. And it also provides a good security and privacy. But It lacks physical monitors to monitor patients apart from the video stream. The doctors will have to diagnose the patient’s illness from the video call alone, which makes doubts in the reliability.

The UMHMSE [3] is designed for Elderly where the patient will use a bio signal sensor to capture the relevant data and transfer them to the server through GPRS. The health practitioners will use the gathered data to diagnose the case on demand and the family members can also view it where they might not get what it means by. Regarding to the privacy and security, nothing has been mentioned in the article whatsoever. Nevertheless, this uses a heart rate monitor to capture the data and It uses an Intelligent Central Node (ICN) where the data will get captured. For this, they have used a Mobile Phone. At the end, it will send the GPS location of the patient and the captured data to a central server. However, this could be used for hospitals in order to capture the data and diagnose the condition of the patient.

Kakria in International Journal of Telemedicine and Applications [4] is aimed for general consumers who need to eliminate the inconvenience of meeting a doctor. It is also using a wearable device, which is used to get the heart rate of the patient where the data stream will be sent to the web server. In addition, it supports multiple user profile selection for convenience. And stated about the privacy issues happens when the system gathers the health-related data from the patient. But it has not provided a way to eliminate these privacy issues arisen due to the personal info extraction during diagnoses. It also sends the GPS records of the patient and warns if the patient’s heart rate gets abnormal. It uses third party Blood Pressure monitors (Zephyr BT) and using Bluetooth to communicate with the Android device to stream the data it captures. And also has a web application, which could be used for the doctors to diagnose the case.

Students of Institute of Electronics, Chinese Academy of Sciences [5] use 3AHcare node to capture the data from the

<sup>2</sup> General Data Protection Regulation (EU) 2016/679



patient. It consists of a blood pressure, heartrate, blood oxygen and respiration pattern monitor. The devices have to wear over the body to get the stream to work on. Thus, it is not convenient to use the sensors while wearing a shirt. Zigbee and Bluetooth is used to communicate the data to the mobile device. There is nothing included regarding to the privacy and security.

“Physical Unclonable Functions can be enabled into smart cards of medical staff and patients personal servers (PDA/Smatphones) for secure and efficient authentication. A PUF is a physical pseudo-random function which is derived from the small variances in the wire and gate delays. These delays are unique for every hardware. Therefore, these are impossible to create duplication”  
(Swand, A. and Ahmad, K., 2017)

Swand and Ahmad (2017) [6] states that the eHealth monitoring systems in the hospitals should use privacy protections and good security mechanisms. It aims in providing a health care solution with the security in mind. It suggests using a trusted authority as the Certified Authority for the key verification. And further states about the use of a cloud security provider as a good security practise. It highlights the fact that how convenient to use the access keys by having a predefined policy for the keys. Moreover, it states about the Physical Uncontrollable Functions. It states that the access keys should not be stored in the volatile memory.

### III. BACKGROUND, OBJECTIVES AND DELIVERABLES

The background to develop such system is the high demand for the medical industry in previous years. Even though the hospitals are there, the patient tries to diagnose the medical condition from their own and sometimes it fails. This happens because of the complicated and the bad experience they get from stepping into a busy hospital [1]. Sometimes, the condition becomes worse as the surroundings are feeding to the disease. In such scenario, it is essential to meetup the doctor even if the patient is in senility or young age. The main objective of this project is to eliminate the hassle of the government hospitals in Sri Lanka and other countries. Other than that, these objectives should be satisfied,

- Providing a better and reliable way to meet the doctor; unlike any other solution.
- Providing a Comprehensive solution which is simple and user friendly.
- To serve the general public as a free doctor consultation service (The doctors get paid as usually by the government. There is no cost in using the “HealthXStream” in this scenario).

The deliverables include a fullyfeatured mobile application which can be installed on Android Devices, which could be used as the doctor-patient communication platform whereas the Arduino sensors will be used if the doctor requires such readings.

### IV. USE CASES

#### A. As an Emergency Medical Service

The solution provides a fast and convenient way to get contact with the doctors. No matter where the patient or doctor is, the patient can contact a doctor if the doctor and the patient have the mutual need.

#### B. A reliable solution to the Doctor-Patient communication with privacy in mind

As we are living in the 21st century, the privacy becomes a big trouble in the western world where the big companies trying to understand how the people mind works on different situations and even they could trace the personal information of anyone who has used the system. However, in “HealthXStream”, privacy is guaranteed. None of the developers nor a third party would be able to trace, extract or manipulate the personal data.

#### C. On demand health check-up for seniors

People in senility are advised to relax more to be on the safe side. It is inconvenient to take them to the hospital to meet up a doctor as it takes much time and patience. With “HealthXStream”, the seniors can book the doctor from themselves and they could find a solution based on the diagnostics made by the doctor.

#### D. For people who is hesitating to meet the doctor

Some people are having the shyness to meet the doctor, for them, this is a great solution as it provides anonymous doctor channelling.

#### E. For the people who have no time to meet a doctor at their presence

Most of the people are busy nowadays, it is convenient to have a doctor session through the mobile phone while having the related sensor readings to effectively diagnose the condition.

### V. TECHNOLOGIES USED

“HealthXStream” is completely developed using the latest trending technologies in the industry. Such as AWS<sup>3</sup> IoT, Lambda, IAM, CloudWatch, Arduino, Native Android development with Java, Eclipse Paho and MQTT. Used tools such as MQTT FX, Android Studio, Arduino Code Editor. Usage of AWS has led into a flexible developing approach where it provides many services which could be used while the development is going on. AWS has provided AWS IoT where it primarily uses MQTT and acts as the broker. The MQTT plays a huge role here by providing the core communication service for the end-users without much overhead and in a secure manner. Since it has internal rules covered up with Lambda and other services, it is easy to manage the complexity of the project where its management console gives the freedom to learn and develop at the same time.

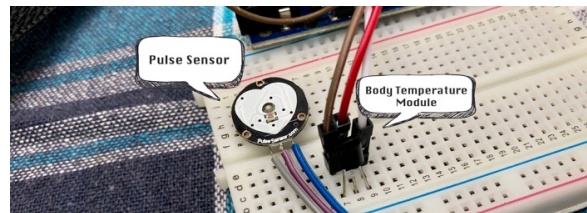


Fig. 2. Sensors

The IAM defined access keys give the best-in-class authentication management procedure. The IAM access keys are flexible to manage in this project as the real-time user count might exceed thousands of users. The reasons to

<sup>3</sup> Amazon Web Services

choose the above technologies are, it provides the latest security and performance increments without much of a hassle. Many of the technologies are becoming obsolete, as it not adheres to the cloud environment natively. AWS comes in handy where the developer gets what they need, with the best cloud solutions it has to offer.

Arduino has been chosen as the IoT device to monitor the patient's pulse rate and the body temperature. the sensors have been connected to the Arduino Uno R3 board for the usage of gathering data from the physical body [see Fig. 2]. The LM35DZ sensor is used to capture the temperature on user involvement. And the pulse rate monitor is there to capture the heart rate (BPM) of the patient. The data output is serial and thus, the data is much more accurate and needs post processing to get a meaningful output [see Fig. 3.]. In the Heart Rate monitor, it gives a 6-digit raw data output which streams over 100 times in a second.

A breadboard has been used in addition to the Arduino Uno, which helps in congested situations where the wire management is critical. Additionally, the data output has been calibrated to filter only the human readable and sensible output whereas; in some cases the output seems rogue as the sensor is operating in serial mode. Which is why the calibration being critical for such setting. The Mobile Application is completely developed in Android Studio which is the recommended tool for building native Android Applications. Through the testing made to the Mobile Application, 4 emulators have been used with Android Marshmallow, Nougat, Oreo and P beta. And a Nokia 2 and a Samsung Galaxy J2 Pro have been used as the physical devices for testing. The Mobile Application is completely developed with Java as it is widely accepted and there is a broader range of communities to help on demand. Physicaloid and Eclipse Paho libraries were used to gather the data from the USB serial connection and act as an MQTT client in Android in sequent. Adobe Photoshop has been used to make the User Interface elements in the Mobile Application.

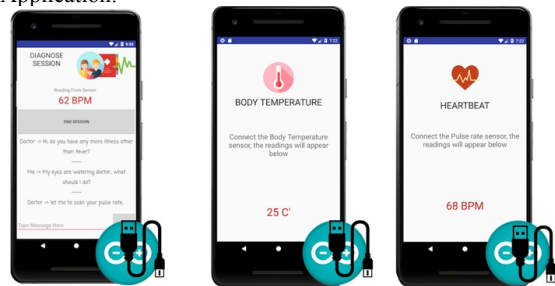


Fig. 3. Arduino connected with USB Serial Connection to the Mobile Device

The code base has been divided into meaningful classes and packages where the best coding practices were followed. There are separate packages called “Doctors Act” which has the relevant controllers for the doctors and there is a separate package for the Encryption Algorithms as well. The ‘mqttConnectionPackage’ has the utility classes for the use of managing the MQTT services where the NoSSLv3SocketFactory class has the methods to convert the rogue TLS1.2<sup>4</sup> made by the Android 4.4. And the “USBSerialAnalyserPackage” has the code-base related to

the USB readings initiation and gathering. Rest of the classes is there to handle the Patient activities when in need.

To test the MQTT Connection flow happening between the clients, MQTT FX has been used to capture the stream to payload testing. This tool has been used extensively when developments are going on since it shows the JSON payload goes through the stream as well as the MQTT topic it is sending to. It needs the same certificate files and keys as the Android Application. Arduino IDE<sup>5</sup> has been used to capture the readings input from the sensors. The code base has been written to convert the raw input to a meaningful output. At first, the Pins have been initiated and declared in a global scope. From there onwards, the serial readings were captured and printed a decimal output. Pulse sensor has used a library from the manufacturer of the sensor where it curates the pulse gatherings per minutes and whenever, a beat has been captured, it will print the per minute value based on the previous calculations.

## VI. SECURITY IN PRACTICE

As the “HealthXStream” completely transfers the real-time doctor-patient communication through MQTT, the messages could be tapped if the broker is accessible without any security mechanisms. In this system, the communication between the doctor and the patient is end-to-end encrypted using the public, private and CA authority keys. No one could get access or tap into the system to listen to the stream of the data transfer. It also uses TLS1.2 protocol to ensure the best industry security practices are in use. The reason to choose TLS1.2 is it is the most stable and up-to-date secure connection protocol for the use of the general public and it is also compliant to the RFC 5246 [7]. It is far better than SSLV3 where the SSLV3 falls behind the exploitation technique known as POODLE where it was discovered by the Google Engineers [8].

“The negotiation of a shared secret is secure: the negotiated secret is unavailable to eavesdroppers, and for any authenticated connection the secret cannot be obtained, even by an attacker who can place himself in the middle of the connection”

(The IETF Trust, 2008)

The only predefined data is the login credentials of the doctor. Since the doctor is a main actor of this system, it is essential to practise the best security with the saved data. For that, “HealthXStream” has encrypted the doctor's password using the industry leading AES256 algorithm where it is compared with the hash generated by the mobile device of the relevant caller. Thus, even though an attacker gains access to the MQTT stream/flow, he/she will not be able to break the authentication in any manner. And, the doctor should provide the relevant Doctor ID first. This ensures a three-way checking for the authenticity. Even if an attacker gains access to the MQTT broker, he will not be able to get in touch with the password as it is completely encrypted. Thus, it is harder to have a Brute-force attack as the mobile application uses some processor power to encrypt the password to generate a hash.

The client ID is randomly generated for each session, it is very complicated to understand the stream/flow even though the attacker digs deep in to the system as it acts as an

<sup>4</sup> A secure protocol used to transfer data

<sup>5</sup> Integrated Development Environment

obfuscation to the information transferred. And each MQTT payload is constantly checks with the “Reason” key in the AWS Lambda where it gets filtered into different queries, it makes the rogue payloads to throw away from the stream. Even in the AWS Lambda, the access keys (which is completely different than the certificate key files imported into the client applications) has been generated using IAM console where it becomes more secure as it provides only local access to the AWS IoT. In case of a spontaneous access key expose, a new access key can be generated and remove the existing access key permissions to secure further actions made by the Lambda Rules.

## VII. CONSIDERATIONS TO PRIVACY

“GDPR is by far the most comprehensive framework for data protection and the widest, given its extraterritorial effect. It remains to be seen how strict the EU will be in enforcing the regulation but a case from four years ago offers some clues” (Jackson, O., 2018) [9]

The rise in Data Protection in the Europe has been dramatically increased past 3 years since it has been approved by the EU parliament on 14th April 2018. GDPR is a regulation which was released due to huge privacy breakups happened in past decade. It is become effective from 25th of May 2018. If any system does not comply with the GDPR, they have to pay a huge fine to the authority until it complies with it. Only the EU has taken actions against these violations. However, no one have ever implemented a real-time health monitoring system with GDPR compliancy. It is proud to state that the “HealthXStream” is the only fully aligned consumer grade real-time privacy-oriented health monitoring system with the EU GDPR compliancy. Many steps were taken into consideration when building the system to be compatible with the GDPR. This not just involves working on the user experience. This is more than what developers think. In order to comply with the GDPR, the software system should not expose any data to any human or a machine where they could make decisions based on the data without a prior consent from the customer. This also applies to the developers. The developers should not have the access to the personal data of the consumers without their consent. However, to achieve the GDPR in its greatest, the software system should not make any signature or a fingerprint of any consumer. Simply, the software system should have built from the ground up to cover-up any privacy leaks. The “HealthXStream” does not save patient’s data in any manner where no one could get accessed to their personal information. The real-time communication happens without exposing any personal data to the doctor and no one could tap into the workflow/stream as it has been encrypted using private and public keys. And the doctor cannot even trace the IP-address of the patient as the MQTT broker acts as an independent intermediary between the doctor and the patient. And as it is also wrapped in TLS1.2, it is sensible to verify the data integrity.

“The primary goal of the TLS protocol is to provide privacy and data integrity between two communicating applications” (The IETF Trust., 2008) [7]

This is how the “HealthXStream” system complies with the GDPR,

- Breach Notification – Upon a Data Breach, the logs can be generated and investigated using the AWS CloudWatch and make the users aware about the fact that the data has been breached.
- Right to access – “HealthXStream” does not retain any data from the patients. All the data flow is happening in real-time. And as soon as the message arrives to the destination, it will not store the data other than forwarding to the relevant user. However, if a doctor requests to have his/her personal data, the data can be provided with ease.
- Right to be forgotten – The Doctor can always make a request to delete the personal data belongs to him/herself. And the patient does not applicable for this as there is no single data belongs to patient saved in any manner. The moment the patient becomes disconnected, the data from the mobile device get removed also (The data has not been saved in the Mobile application. The current Activity/view has the value assigned to it. Such as Temperature, Pulse Rate etc. Those are saved inside the volatile memory. Even it gets cleared once; the patient closes the application or cancels the session). The moment either the doctor or the patient disconnects from the system, if the patient-doctor has an available session going through, both device state becomes as it was before (the Activities get finished/closed from the application and redirected to a new Activity where it calls for the onDestroy() method which will let the garbage collector to wipe the volatile data thereafter).
- Privacy by design – As mentioned in this section, the application is built from the ground up with privacy in mind. And it is immune to attackers as the whole system has followed the best security practices. No one could gain access easily.

It is a great advantage to align with the GDPR since the strict legal enforcements spreaded through the EU. It totally opens the gate to provide the health monitoring with the “HealthXStream” system among the EU territory as well as the whole world. It is a huge market gain.

## VIII. CONCLUSION

The business model is pretty straightforward as the Sri Lanka is indeed in need of a better and simplified healthcare. “HealthXStream” is built for the public rather than niche customers. However, after successful marketing through gaining popularity within the government hospitals, this could be introduced into the private hospitals with subscription plans. The client is also in need of such system where anyone could see when stepped into a Sri Lankan government hospital where it becomes too congested most of the time. And as being GDPR compliant, this solution is one of a kind. The project will not be made as up to this level unless the selected technologies were not suitable. And the comparison between the alternatives will no longer needed in the long run as the “HealthXStream” does its job as intended. This could be improved furthermore in the future by addressing the consumer needs.

## IX. FURTHER WORK

The approach is to make an investment in the government health sector. The project can be extended to use

in the government hospitals where patients and doctors need a swift communication temporary in scenarios such as the doctor and nurse checks the patient regularly. However, it is a huge burden to the doctors and the patients to get contacted as there are limited number of doctors available in a section. Many of the patients suffer from acute pain and they cannot be reached by the doctors immediately. In this case the doctor could get contact with the patients quickly using the "HealthXStream" where the patient could express their problem and the doctor could diagnose the problem as soon as possible. In order to effectively practice this, the sensors can be optimised to provide a more reliable counting on the readings and various types of sensors can be used to help with the diagnosing.

Apart from the government sector, the private hospitals can be targeted once it goes viral in the government sector. It can be improved furthermore by making the sensors more portable. And the application will be developed to make compatible with the Apple devices, where it can be placed in AppStore and PlayStore. And it is better to provide a multi-patient handling tasks within the application. Which means the doctor can get connected with many patients simultaneously through the application. Currently, a doctor can make a connection with one patient at a time. There is no limit other than that. E.g. If there are 100 doctors and 100 patients, each patient can make an appointment and have a session at the same time without any intervention. However, if the doctors are limited to 10, only 10 patients will have the chance to have a session with the patient while others have to wait until a session ends. This needs ground-up development in the MQTT message transfer buffer.

Continuous Integration can be implemented to automate the testing and the build system. Then it will be easy for the developer to maintain the code and the version hierarchy. This could be done using Jenkins which is connected with the GitHub.

According to Beaver (2018) [10], it is better to adapt to the Blockchain technology with the health data. As it cannot be tampered by anyone alone. As this project only stores the Doctor's data, only the Doctor's data can be saved inside the Blockchain. However, it will store only the hash where the Lambda function will generate a hash based on the local storage values and then it will compare that with the relevant

hash inside the Blockchain to make sure the data is not tampered by any means.

#### ACKNOWLEDGMENT

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# Standard Web Application for Flight Booking

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**Abstract**— Web services are loosely coupled software components that are a popular implementation of the service-oriented architecture. Web services have been extended to give value-added customized services to users through service composition. Online flight booking is a major application of Web service. Travelers are also relying more on travel review sites when booking. However, one of the major problems of development of the online reservation system is when we are connecting web services from different web service providers then we have to develop different programs to calling each of them. Because, each service providers provide different data formats as their response data. Therefore, Engineers have to learn about that from the bottom of the line. Another problem of the existing online reservation systems is reservation systems are different with each other. That is increasing the complexity of the system when using the consumer. There are not available travel agent web site standards. When a new system is built it's hard to find the proper standard methodology. So that makes very hard to developers, architectures, business peoples to develop a system that internationally accepted. This research studies mainly focusing on defining those standards and each and every travel agency sites will be on the same standards so that the users and other parties who are involved in the travelling purpose will find very easy to use this reservation systems because there is the same standard which is internationally accepted.

**Keywords**—web service, JSON, booking systems

## I. INTRODUCTION

Internet is the latest in a long series of communication technologies. As stated in the term “an internet service presents a classification of objects to perform a certain services to different users”. Society is generally known as a group of people who deal in a virtual environment, adopting online services in various societies gives the opportunity to model and formulate contents. Communication services become one of the most important applications in the world for providing clients with the intellectual services. The online booking system for the meeting and seminar halls will provide flexible and sustainable services for saving time and emulate mistakes. From the other hands, users are looking for an interactive and easy way to communicate and do their jobs via Internet. The usefulness of the providing such a reservation service is to help administration staffs in their daily work by making their reservation up to schedule, connected, and generating reports easily. Most of these applications build and design based on a certain strategy to fit the expected needs and generate the user desires. Different strategy units perform to varying levels against each other, and come at varying satisfaction.

Goal of the every booking agency is to sell more rooms and make profit. Yet, without an online booking system, user will have to rely on phone calls and walk-ins only to make reservations. An online booking system works all the time [1], which gives freedom to potential visitors to book a room anytime they want. It also maximizes sales because provider is not limited to the working hours. In fact, studies show that a 24/7 online reservation system greatly increases the number of hotel bookings.

Flight reservation system will make provider's staff more efficient. They will not be phone waiting for guest calls. Another major benefit of the online flight reservation system is that it is much easier to create, publish, promote and sell packages and add-ons online. Booking Agency can combine them or let customer to choose the package they need. This will further increase the revenue of the booking agency while customers will be able to get exactly what they want.

The online travel industry primarily made up with travel e-commerce sites and review sites. Travel e-commerce sites specialize in the selling of travel products such as flights, hotels, and rental cars. These can be either purchased directly through a travel company's website, such as the Lufthansa website, or through an online travel agency (OTA), such as Expedia [2]. Travel review websites, such as Trip Advisor [3], allow travellers to post their experience of hotels, restaurants and other hospitality purchases online. These companies often generate revenue via advertisements on their sites.

Travellers are also relying more on travel review sites when booking. The share of United States travellers who said travel review sites influence their travel choices increased by 10 percent between 2014 and 2015. The leading travel site used in United States based on number of visits was, however, not an online travel agency. As of October 2016, TripAdvisor, which operates primarily as a review site, gained the highest share of travel website visits by 13.8 percent [4].

However, one of the major problems of development of the online reservation system is when we are connecting web services from different web service providers then we have to develop different programs to calling each of them. Because, each service providers provide different data formats as their response data. Therefore, Engineers have to learn about that from the bottom of the line. Another problem of the existing online reservation systems is reservation systems are different with each other that increase the complexity of the system when using the consumer.

In this paper, we proposed JSON format for response data for reservation web service providers, and provide a

significant model for the reservation web services to keep their standards and reduce the complexity of reservation system when check the consumer. The JSON format of the output of web service response mainly considers the capacity of the response message and reducing the complexity. In this paper, we focus on online flight booking system.

The rest of this paper is organized as follows. In section II, we present the proposed web application. Section III discusses functional based clustering process. Section IV describes our proposed QoS aware clustering approach. Section V discusses our experiment and its evaluation. In Section VI, we discuss related works. Finally, Section VII concludes the paper.

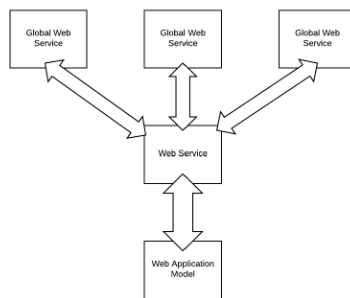


Fig. 4. Web service architecture

## II. PROPOSED WEB SERVICE

### A. Collecting and Analyzing Data

First, we created a questioner related to online booking system. We collected data from foreigners who travel in Sri Lanka and Web service developers who are involving in developing flight-booking system. Further, existing booking services were analysed to identify key features. Airline filter and outbound and inbound times filter were two identified filters among them. Mentioning Baggage size on result page and Airline ratings and rating filters are features suggested by the consumers. Developers suggest flexible type search feature.

### B. Designing

Figure 1 shows the web service architecture. Important part and very complex part are planning and designing the result page. According to discussed information and consumer suggestions of booking websites, we have designed a result page block. When designing the model of the system we have to consider about two main parts such as the web service and the web application.

### C. Implementation

C#, HTML, CSS, JQuery, Angularjs were used as development languages. MS SQL was the database management system. Development framework was .net framework.

### D. Identify the JSON object properties and tables

JSON object uses for invoke data from web servers. According to requirements, we have to decide what kind of JSON property we have to invoke for result page. We have designed two property tables called Itinerary and Flights. Then we developed the web application that used by MVC (Model View Controller) framework and three tier architecture. Figure 2 shows the three-tier architecture.

Assume we want to select or recommend a Web service from collection of functionally equivalent services with varying QoS values. Then, selection algorithm has to select a service with optimal QoS values from all the services in the search space. However, if we cluster the services based on QoS values, then we can reduce the search space as in Fig 1. First, we can identify the cluster with better QoS values (i. e. cluster 3) and then, selection algorithm can limit the searching process within the cluster.

Back-end of the web application was developed by c# language and entity framework was used for the access to the database. SQL DBMS uses for manage the local database. Local database has seven (7) tables. Local database was used because of fixed data. If those data also come from web services that affect to the system processing time and data usage. To reduce system processing time and data usage we used local database for those fixed data those tables are airline table, flight destinations mapping table, flight fares table, subscribers table, airline codes table, airport code table, and city code table.

Front end of the web application was developed by C# razor bootstrap, jquery and angular. This application has some frond end logics because of that, we have used angular controller on front end. Presentation layer of the project was developed according to MVC architecture.

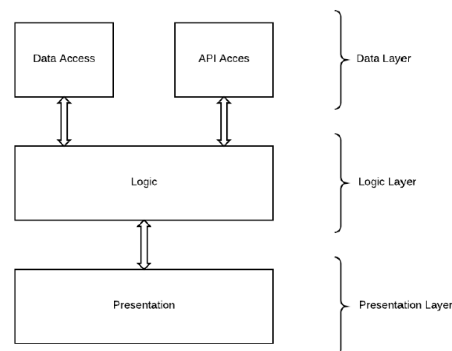


Fig. 5. Three tier architecture

## III. RESULTS AND DISCUSSION

Search inputs page of the flight booking application was designed by a common way that usually can see on booking websites. Figure 3 shows the interface of the main page. Departure input, Arrival input, Departure date, Return date, Passenger inputs, One-way type button, Return type button



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and +/- 3 Days input are some input box and button in the page.

Fig. 6. Interface of main page

Most important part is the result page model. In that, we have to focus about lot of things. According to our research when discuss with the developers and consumer that related to the booking systems they most of the times mentions the airline filtering methods.

E.g. – Someone like to select their itinerary from British Airways so we have to provide British airways itineraries. For that, all the itinerary results were grouped by its' airline. Following fig. 4 shows results of return type search inputs. As the result, page system will show one div to each airline. If consumer wants to see other itineraries of particular airline, he/ she has to click on more flight combination button. Figure 5 shows the interface. When select the itinerary, system shows details window of particular itinerary as following fig. 6.

Fig. 7. Results page

Fig. 8. More Flight Combination view

Fig. 9. Details window

JSON objects were used for the parse data between web application and web service. Travel agent organizations can use this format for their web services as a standard. This JSON object must be including all the dynamic data to the result page. Following fig. 7. shows sample flight table JSON object.

```
{
  "Flights": {
    "RfNo": 5,
    "SegOrd": 2,
    "LegNo": 1,
    "OptCt": 2,
    "ARL_COD": "9W",
    "FLI_NUM": "542",
    "DEP_ARP": "BOM",
    "DEP_DAY": "We",
    "DEP_DAT": "110718",
    "DEP_TIM": "0920",
    "ARR_ARP": "DXB",
    "ARR_DAY": "We",
    "ARR_DAT": "110718",
    "ARR_TIM": "1100",
    "EQP_COD": "Boeing 73H",
    "MEA_COD": "-",
    "NUM_STO": 1,
    "DEP_TER": "2",
    "ARR_TER": "1",
    "ACC_TIM": "x",
    "ELAP_TIM": "0310",
    "GRO_TIM": "0105",
    "Class": "W",
    "DEP_ARR_DAT_DIF": "0",
    "InfoVia": "AM",
    "TechnicalStop": "-",
    "Codeshare": "NO",
    "ReplaceAir": "XX",
    "FareBasis": "W2SP1MLK",
    "MajorCabin": "M",
    "Baggage": "2PC",
    "Extras": "-",
    "FliRefNo": "D542"
  }
}
```

Fig. 10. Sample JSON format

Details of some attributes are given bellow.

Attribute Name	Type	Description
RfNo	Int	Reference Number
SegOrd	Int	Segment Order
LegNo	Int	Leg Number
OptCt	Int	Option Code
ARL_COD		String Airline Code
FLI_NUM		String Flight Number
DEP_ARP		String Departure Airport
DEP_DAY		String Departure Day
DEP_DAT	String	Departure Date
DEP_TIM	String	Departure Time
ARR_ARP	String	Arrival Airport
ARR_DAY	String	Arrival Day
ARR_DAT	String	Arrival Date
ARR_TIM	String	Arrival Time
EQP_COD	String	Equipment Code
MEA_COD	String	
NUM_STO	Int	
DEP_TER	String	Departure Terminal
ARR_TER	String	Arrival Terminal
ACC_TIM	String	
ELAP_TIM	String	
GRO_TIM	String	
Class	String	Passenger Class

#### IV. RELATED WORKS

Mobile application is the one of the most important things in human day-to-day life. For expeditiously analysing the potential advantages of the Mobile Airline Reservation System (MARS), research work [5] investigated existing procedure of seat reservation in the Nigerian Aviation Industry and clarified potential advantages of the broad selection of MARS. The paper discussed about the five product compositional model of MARS and presumed that its power usage with ongoing versatile access the nation over can spare time, cost, and different dangers. Research work [6] discussed about the better mobile applications of flight ticketing. According to that, 90% of travel bookings are done online. Airlines still sell the majority of tickets, but finding and comparing them now takes place on third-party ticket search engines that offer flights from thousands of suppliers globally. This article says higher competition of the travel industry will be better for the travellers and bad news for the flight ticket industry because of higher competition means lower profit margins, which translates to cheaper ticket for the end-consumer.

Researcher [7] provided a summary of the study that was undertaken to design and implement an airline reservation system. The airline reservation system designed in that project was developed using PHP, Java script and HTML. The researchers reviewed the literature of reservation systems and explored the advantages and limitations of reservation system in real life situations. He also used interviews and questionnaire methods during the data collection phase. Case tools and data flow diagram were used during the development process to simulate the process of

airline reservation and ticket booking. The outcome of the study was an online airline reservation system tested and implemented in the case study Rwenzori Airlines to book, schedule and reserve flights.

According this the history of the computer reservation systems (CRS) in airline industry days back to 1970s. The airline began modifying and enhancing their internal reservation system to make the sale of airline tickets through agent more efficient. The CRS gives travel agent for information about flight schedules, fares and seat availability. It enables to flight reservation and issue of tickets automatic. An agent based mobile airline search and booking system is being developed. In addition, they provided a method to perform the search of the airline using biometrics. [8]

In this paper, we proposed JSON format for response data for reservation web service providers, and provide a significant model for the reservation web services to keep their standards and reduce the complexity of reservation system when check the consumer.

#### V. CONCLUSION

Travel industry is a one of major industry around the world. Airline Reservation System (ARS) has led to ease of airline ticketing, flight scheduling and provided a mean for customers to access and book flights with ease and in time. It has also increase the speed with which information about customers are retrieved, handled and flight scheduling it tasked. There are not available travel agent web site standards. When a new system is built, it's hard to find the proper standard methodology. So that makes very hard to developers, architectures, business peoples to develop a system that internationally accepted. This research is mainly focusing on defining set of standards so that every travel agency sites will be on the same standard. Users and other parties who are involved in the travelling purpose will find very easy to use this reservation system because there is an internationally accepted standard.

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# Drivers Nurturing the Adoption of Green Initiatives in a Developing Economy

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**Abstract**—As far as developing economies such as Sri Lanka are considered, industries' concern towards environment is comparatively low and the knowledge on GSCM is also considerably less. It is therefore important to identify the motivators for firms in developing nations to adopt GSC initiatives. The target population of this study were manufacturing firms in Sri Lanka. Senior managers or executives from respective firms were chosen as the representatives from each firm. The population was represented through a convenience sample of firms covering the entire country including the nine provinces and the main industrialized areas. An online survey questionnaire was administered to collect data from the sample. The research reveals four crucial drivers of green supply chain adoption that collectively affect a firm's adoption of Green Supply Chain initiatives. Organizational characteristics, Customer pressure, Corporate Social Responsibility and, Branding advantage are the identified drivers. The research results lead to some practical implications for advancing green practice adoption in Sri Lankan manufacturing industry. Firms need to be committed to, and sustain top management support, improve human resource capabilities, improve and make organizational resources easily available for their employees. Large and foreign customer firms should formulate regulations that their suppliers must adopt certain GSC initiatives such as acquiring ISO 14000 certification. The government, financial aid organizations, society and the supplier groups must re-evaluate their current actions and think of better approaches to motivate firms to adopt GSC initiatives. Future studies can use the findings and the proposed model to other countries, industrial sectors, and green practices.

**Keywords**—Supply chain management, Green supply chain, Environment, Developing economy, Sri Lanka

## I. INTRODUCTION

GSC strategies refer to efforts to minimize the negative impact of firms and their supply chains on the natural environment. GSCM can reduce the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization efficiency. It involves a paradigm shift, going from end-of-pipe control to meet environmental regulations to the situation of not only minimizing ecological damage, but also leading to overall economic profit. The area throws various challenges to practitioners, academicians and researchers (Srivastava, 2007).

Sri Lanka's manufacturing sector's contribution to GDP increased from 5% in 1955 to 23% by 1977. However, Sri Lanka began to shift away from a socialist orientation in 1977. Although successive governments facilitate to develop manufacturing sector over the years, they could not up with stringent measures to minimize environmental and social impacts, which are coming along with the development and expansion of the industry. According to Kulatunga, Jayatilaka and Jayawickrama (2013), since policy makers'

prime objective is to provide employment for local and to promote foreign direct investments for establishment of industries, they do not pay due concern on environmental and social problems which arrive along with the projects..

The purpose of this study is to identify the factors motivating Sri Lanka's manufacturing industry to adopt GSC initiatives. The study would also compare and contrast the motivators pertaining to developed, emerging and developing economies so that the findings can be adopted when making policy decisions in these countries. It contributes valuable insight into the drivers for successful implementation of GSC initiatives, especially in a developing economy such as Sri Lanka. The role of the drivers is crucial in motivating firms to adopt GSC initiatives and facilitate their adoption. Firms in developing countries need to realize that GSC initiatives can result in significant benefits to their firms, environment, and the society at large which gives them additional incentives to adopt these initiatives. The findings of this study can be used to bring in potential organizations to surface in addition to filling the present vacuum available within the country. Further this study will be useful when developing policies in future not only for Sri Lankan context but for other developing countries as a whole.

## II. THEORETICAL BACKGROUND AND LITERATURE REVIEW

### A. Green Supply Chain Management

In this research, we used the term GSCM as 'the process of green purchasing, green manufacturing or materials management, green distribution or marketing and, reverse logistics' as defined by Hervani et al. (2005). The term 'green' has been used in the sense of 'concerned with the protection of the environment; supporting the protection of the environment as a political principle' as defined in Oxford Advanced Learners' Dictionary (2016).

### B. Drivers of Green Supply Chain Initiatives

In this study "drivers" are defined as motivators that encourage organizations to adopt GSC initiatives (Hoffman, 2001 and Hsu et al., 2013). Based on the literature, these drivers can be divided into two main categories. They are internal drivers and external drivers.

#### 1) Internal Drivers

Internal drivers are described as organizational factors (Walker et al., 2008). In general, all the internal drivers can be sub-categorized into organizational capabilities and readiness, human resource and its capabilities, management support and commitment, need to reduce costs and improve quality and, owner/ shareholder pressure.

#### 2) External Drivers

##### a) Regulatory Factors

These official mechanisms take the form of standards, laws, procedures and incentives set by regulatory institutions to inspire firms to become environmentally responsible (Hsu et al., 2013). A significant body of research indicates that government regulation and legislation is a major driver for companies' environmental efforts (Walker et al., 2008). This is applicable to supplier organizations as well. The government can play an important role in motivating these suppliers (S.-Y. Lee, 2008). Business organizations are expected to adopt green practices in response to environmental regulations set by various regulatory institutions such as government bodies in the country, overseas RG mainly applicable to export companies, in additions to regulations set by the parent companies (ElTayeb et al., 2010). The next dominant driver under regulations is the proactive efforts such as obtaining ISO 14001 certification by the organizations. Proactive efforts towards environmental regulation are more likely to be drivers of successful GSCM projects (Carter & Dresner, 2001). In summary, external regulation and legislation appears to be a strong driver for adoption of GSC initiatives.

#### b) Customer Pressure

Customers, as a major financial stakeholder, can exert considerable pressures and demand goals of sustainability or environmental performance from suppliers (Doonan, Lanoie, & Laplante, 2005; C.-Y. Lin, 2007; Peng & Lin, 2008). The literature points to several interesting issues regarding customers as a driving force for GSCM practices (Walker et al., 2008). According to S.-Y. Lee (2008) without a doubt, buyers, particularly end-user product manufacturers in supply chains, are the most important and influential stakeholders for the suppliers.

#### c) Competitor Pressure

Several authors identified competition and competitive advantage as drivers for GSCM practices (Walker et al., 2008). Large and successful firms in an industry usually face intense scrutiny from competitors and external environmental activists (Zhu and Sarkis, 2007, cited in Hsu et al., 2013). Hence many organizations work in an environment that includes pressures from their competitors that induce organizations to adopt green initiatives to combat competition and gain competitive advantages (Carter and Ellram, 1998, cited in Hsu et al., 2013). Porter & van der Linde (1995) and Rao & Holt (2005) states that a policy of environmental purchasing may not be undertaken because of a desire to 'save the world', but because it reflects a way to gain competitive advantage, improving the financial performance of the firm.

#### d) Social Pressure

The deterioration of the environment over recent decades has drastically increased the public's awareness of environmental issues. The public is increasingly influenced by a company's reputation with respect to the environment when making purchasing decisions (Drumwright, 1994). Switching to environmentally friendly components to minimize the environment impact or instituting efficient ways to verify sourcing of raw materials is now considered a crucial task by manufacturers (Hsu et al., 2013). Greening the supply chain can help a company to have a more favorable reputation. In terms of their competition, corporate social responsibility could be another area where an advantage could be gained, particularly in the area of public perception (Spence & Bourlakis, 2009, cited in Kohi & Hawkins, 2015).

#### e) Supplier Pressure

It has been suggested that suppliers can help to provide valuable ideas used in the implementation of environmental projects, but they generally do not act as a direct driving force (Carter & Dresner, 2001). Diabat & Govindan (2011) has also identified that environmental collaboration with suppliers is an influential factor. It was found that greater supply chain integration can benefit environment management in operations. As the supply base was reduced, the extent of environmental collaboration with primary suppliers increased in the manufacturing plants where the study was conducted (Vachon & Klassen, 2006).

### III. THEORETICAL AND HYPOTHESES DEVELOPMENT

By referring to existing literature on the streams of GSCM and drivers encouraging the adoption of GSC initiatives, drivers for adopting GSC initiatives could be articulated under six categories: organizational related, regulations, customers, competition, society and, suppliers. The following six hypotheses were developed accordingly.

Construction of the instrument was begun by generating items from a review of the literature and from suggestions from practicing supply chain managers and EMRs. The items, which were statements describing specific drivers of green supply chain initiatives, were placed in questionnaire format using a five-point Likert scale ranging on a continuum from "Strongly Disagree" to "Strongly Agree." The items were then screened for ambiguity, wording, and content overlap. To ensure content validity, the items were subjected to the scrutiny and evaluation of three experts: a director, a supply chain manager, and an EMR cum Operations Manager. The critics were individually instructed to determine which items represented the setting. This process generated 41 items.

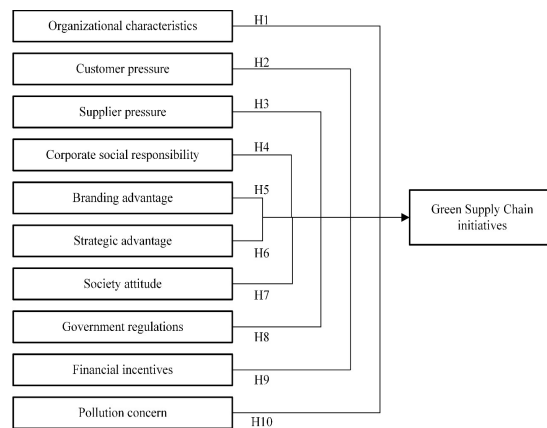


Fig. 1. Conceptual Framework

A principal component factor analysis, using an orthogonal rotation with varimax solution, provided the best solution. The Kaiser-Meyer-Olkin measure of sampling adequacy was good with a value of .806, above the commonly recommended value of .6, and Bartlett's test of sphericity was significant ( $\chi^2(780) = 2716.154, p < .05$ ). All the diagonals of the anti-image correlation matrix were over 0.5. Further, the communalities of the variables were all above 0.5. The suitability of the data for factor analysis was supported by these overall indicators.

All of the variables were inputted to see if there are any latent variables and what components factor analysis would extract and what relationships would be revealed given all of the data. Ten components with eigenvalues greater than 1.0 were extracted. Application of the Scree Test confirmed the ten interpretable factors. The ten factors accounted for 73% of the variance. In order to maximize simple structure and theoretical clarity, items that exhibited factor loadings whose absolute value was .60 or greater were used to define a factor. The 10 items, which did not conform psychometrically or theoretically to any factor were eliminated.

Overall, these analyses indicated that ten distinct factors were underlying the motivation to adopt Green Supply Chain initiatives. With the results obtained from the factor analysis, the research hypotheses were modified as follows.

H1: Organizational characteristics positively affect a firm's adoption of GSC initiatives.

H2: Customer pressure positively affect a firm's adoption of GSC initiatives.

H3: Supplier pressure positively affect a firm's adoption of GSC initiatives.

H4: Corporate social responsibility positively affect a firm's adoption of GSC initiatives.

H5: Branding advantage positively affect a firm's adoption of GSC initiatives.

H6: Strategic advantage positively affect a firm's adoption of GSC initiatives.

H7: Society attitude positively affect a firm's adoption of GSC initiatives.

H8: Government regulations positively affect a firm's adoption of GSC initiatives.

H9: Financial incentives positively affect a firm's adoption of GSC initiatives.

H10: Pollution concern positively affect a firm's adoption of GSC initiatives.

The conceptual framework of the study is presented in Fig. 1.

#### IV. METHODOLOGY

##### A. Research Setting: Sri Lanka

Sri Lanka was chosen as the study setting due to the possibility of generalization as a developing economy in terms of several aspects. Sri Lanka was promoted from a low-income developing country to a lower middle-income developing country in 2010 (International Monetary Fund, 2014) and aspires to become a higher middle-income country (World Bank, 2016). In Sri Lanka, industrialization trends are obvious; the country has moved away from an agriculture-based economy to a service-based and an industrialized economy. In 2015, the manufacturing sector contributed to 28.9 percent of Gross Domestic Product (GDP) and agriculture now contributes only to 8.7 percent of Sri Lanka's economy (World Bank, 2016). Increased industrialization also amplifies environmental concerns, including land, water, and air pollution and degradation of natural resources. Thus, it is important for Sri Lanka to balance an increased standard of living with environmental protections. The incidence of environmental problems has changed with Sri Lanka's economic progress, but increased revenues among Sri Lankan organizations have not yet translated into improved economic conditions. This made the

industries in a developing country such as Sri Lanka good candidates for further investigation.

##### B. The Survey

The target population of this study were manufacturing firms in Sri Lanka. Since there are no records about the number of SME's in the country, the population was represented through a convenience sample of firms covering the entire country including the nine provinces and the main industrialized areas of Colombo, Kandy and Galle (n=1500). The number of firms surveyed and their geo-graphical distribution in the nine provinces enable the generalization of this study's results, thereby strengthening the external validity of this study.

##### C. Instrument development and survey administration

The method consisted of distributing the survey utilizing electronic mail and a web-based technology to the participants. It was first sent to 10 participants as the pilot test. Their feedback was taken to review and modify the questionnaire accordingly. As the next step the online questionnaire was emailed with a cover letter to employees in Supply Chain Executives cadre and beyond, while making sure that only one member from each firm receives and fills the questionnaire.

In total, 132 responses were received from the sample size of around 1500; of those, 106 were complete, resulting in an effective response rate of 7.07%. The low response rate is typical of web-based surveys because respondents were unacquainted with the survey and its purpose prior to receiving it. According to Hair, Black, Babin, Anderson, & Tatham (2010) the absolute minimum sample size required for validity of factors and reliability of results is 50. For optimal factor analysis results, they suggest that there be five to twenty observations per variable. We hoped for 10 responses per factor and met this level with 106 responses for 6 factors.

#### V. ANALYSES AND RESULTS

Data were analyzed by using the IBM SPSS Statistics 22 program to run statistical tests. Correlation analysis was conducted to see the relationships among the variables. Statistical tests of significance were conducted in this study such as logistics regression to provide a value-free and objective result.

##### A. Correlation

In order to determine the correlations between dependent variable and independent variables and among the independent variables, Pearson's correlation test was run in SPSS.

The initial hypothesis predicted a linear relationship between the factors. Pearson's bivariate correlation coefficient shows a positive linear relationship between the dependent variable and Customer pressure ( $r = .293$ ), the dependent variable and Organizational characteristics ( $r = .375$ ), the dependent variable and Corporate social responsibility ( $r = .301$ ) and, the dependent variable and Branding advantage ( $r = .335$ ) that is significantly different from zero ( $p < 0.01$ ).

Null hypotheses for the relationship among independent variables were accepted since no significant correlations were observed among the independent variables ( $p < 0.001$ ).

### B. Regression

Stepwise binary logistic regression was run in SPSS to check if these factors contribute to motivate GSC initiatives and to see if these factors fit into a mathematical model.

The regression analysis was performed using Willingness to Participate in GSC Initiatives (GSC Willingness) as the dependent variable, and Organizational characteristics, Customer pressure, Supplier pressure, CSR, Branding advantage, Strategic advantage, Society attitude, Government regulations, Financial incentives and Pollution concern as the independent variables.

#### 2. VARIABLES IN THE EQUATION

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 <sup>a</sup>	Customer pressure	1.190	.378	9.930	1	.002	3.286
	Organizational characteristics	1.367	.363	14.173	1	.000	3.924
	Supplier pressure	.056	.301	.035	1	.851	1.058
	CSR	1.066	.336	10.066	1	.002	2.905
	Branding advantage	1.227	.348	12.453	1	.000	3.409
	Strategic advantage	.274	.294	.869	1	.351	1.315
	Society attitude	.245	.274	.797	1	.372	1.277
	Government regulations	.174	.337	.266	1	.606	1.190
	Financial incentives	-.399	.314	1.621	1	.203	.671
	Pollution concern	.032	.313	.010	1	.919	1.032
	Constant	1.042	.322	10.438	1	.001	2.834
a. Variable(s) entered on step 1: Customer_pressure, Organizational_characteristics, Supplier_pressure, Corporate_social_responsibility, Branding_advantage, Strategic_advantage, Society_attitude, Government_regulations, Financial_incentives, Pollution_concern.							

Model summary suggests that it is a good model. Nagelkerke's  $R^2$  is 0.603 which indicates that the model is good. Cox & Snell's  $R^2$  is the 106th root of the -2log likelihood improvement. Thus, we can interpret this as 43.9% probability of the firms adopting GSC initiatives is explained by the logistic model. With 83% correct classification, the model is good.

In the Table I, the coefficients, their standard errors, the Wald test statistic with associated degrees of freedom and p-values, and the exponentiated coefficient (also known as an odds ratio) have been presented. Organizational characteristics ( $P=.000$ ), Customer pressure ( $P=.002$ ), Corporate social responsibility ( $P=.002$ ) and Branding

advantage ( $P=.000$ ) were statistically significant and showed a positive relationship with Willingness to adopt GSC initiatives. The logistic regression coefficients give the change in the log odds of the willingness to adopt GSC initiatives for one unit increase in the predictor variable.

With the results of the above analyses, the following four hypotheses of the study can be accepted.

H1: Organizational characteristics positively affect a firm's adoption of GSC initiatives.

H2: Customer pressure positively affect a firm's adoption of GSC initiatives.

H4: Corporate social responsibility positively affect a firm's adoption of GSC initiatives.

H5: Branding advantage positively affect a firm's adoption of GSC initiatives.

Further, the Table I gives the values for the logistic regression equation for predicting the dependent variable from the independent variable. Thus, the following logistic regression equation could be developed for this study, where  $p$  is the probability of adopting GSC initiatives.

$\text{Log}(p/1-p) = 1.042 + 1.190 \times \text{Customer pressure} + 1.367 \times \text{Organizational characteristics} + 1.066 \times \text{CSR} + 1.227 \times \text{Branding advantage}$

### VI. DISCUSSION OF FINDINGS

The regression model for supply chain drivers nurturing adoption of GSC initiatives revealed organizational characteristics, customer pressure, CSR, and branding advantage as the strongest predictors of motivation to adopt GSC initiatives. In addressing these four factors several difficulties may arise. Addressing organizational characteristics will require high financial investments by the firms. Secondly, the customers need to consistently pressurize the firms in order to increase their motivation to adopt GSC initiatives. This is practically possible only by huge customers. In terms of CSR, firms need to be urged to perceive a voluntary obligation to society in order to achieve harmony with social expectations, norms and codes of conduct that dictate acceptable business behaviors. Branding advantage implies that only an increase in the level of competition in the market could further increase the degree of adoption of GSC initiatives.

Findings on drivers which motivate the adoption of GSC initiatives in different economies are given in Table II.

The factors that have been identified in previous studies as to motivate the adoption of GSC initiatives in both developed economies (Kohli & Hawkins, 2015; Walker et al., 2008) and emerging economies (Hsu et al., 2013; C. Y. Lin & Ho, 2011; ElTayeb et al., 2010; Diabat & Govindan, 2011) can be categorized into five main constructs. While some studies have missing drivers, these studies have identified regulations, customer pressures, organizational characteristics, competitive advantage and CSR as the drivers which motivate the adoption of GSC initiatives in both types of economies in general.

Governments of developing economies are usually considered to be of tolerance compared to other economies. Though there are established regulations by the governing bodies, their implementation and punitive actions are not rigid. There are many loop-holes in the laws and law-enforcing authorities where powerful companies can escape from non-environmentally friendly actions. This may be the main reason for regulatory measures to be non-significant in

a developing economy as a driver to motivate the adoption of GSC initiatives.

TABLE II. DRIVERS MOTIVATING GSC ADOPTION INITIATIVES IN DIFFERENT ECONOMIES

Factor	Developed Economy	Emerging Economy	Developing Economy
Regulatory measures	Government Regulation	Regulatory measures	-
Customer pressures	Buyer/Supply Chain Influence	Customer pressures	Customer pressures
Internal measures	Internal Readiness	Organizational structure	Internal measures
Competition	Competitive Advantage	competitor pressures	Branding
CSR	Corporate Social Responsibility	Socio-cultural responsibility	Corporate Social Responsibility

## VII. MANAGERIAL IMPLICATIONS OF FINDINGS

The study revealed that organizational characteristics are a significant driver that facilitates the adoption of GSC initiatives. Therefore, firms must focus on developing their human, process and physical capabilities in order to achieve environmentally friendly practices. Environment-conscious large-scale customers and foreign customers have a significant role in motivating Sri Lankan industries to adopt environmentally friendly behaviour. Sri Lankan industries tend to listen to customer firms and implement green initiatives due to the threat of losing their sales and reputation. For financial donor organizations and the government, this study offers insight into what resource allocation strategies are more likely to positively influence GSC initiatives. In particular, this study suggests direct financial incentives does not help boost required outcomes. Research hypothesis eight demonstrates this phenomenon. This study will also be useful to the government and policymakers in terms of understanding the power of its regulations. Research hypothesis nine indicated that the government regulations are insignificant for motivating organizations to adopt an environmentally friendly behaviour. Therefore, the government must either improve its law enforcement capabilities or look for other ways of motivating the organizations. As mentioned before, financial incentives also proven to be non-effective in this regard.

Another important finding that relates to general public and environmental advocacy groups is the discovery that their pressure is insignificant for firms adopting GSC initiatives. Therefore, these groups must look for other ways than mere protesting or showing dislike.

## VIII. LIMITATIONS AND FUTURE RESEARCH

The findings were mostly consistent with the previous findings on emerging and developed economies. However, government regulations turned out to be insignificant in this study. It is recommended to further explore this factor for developing economies such as Sri Lanka. Developing economies receive numerous financial aids in order to implement green practices leading to sustainable development. Interestingly, the results of this study revealed that financial incentives are not a significant factor in driving firms to adopt GSC practices. This finding should be further studied and verified since this is a crucial matter for donor

organizations to determine the effectiveness of their activities.

A limitation of this study is that it focused only on the manufacturing sector. Some studies (C. Y. Lin & Ho, 2011) reveal that different industries may react differently to environmental issues. Therefore, studies must be conducted to identify if the drivers identified in this study are constant among other industries as well or if there are any variations. The sample for this study was self-selected. Representatives of those organizations that are already more interested in and trying out the GSC initiatives might have self-selected to participate in the online survey. Therefore, the findings of the study must be viewed with caution.

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# Fostering creativity through interactive workshops. An analytical study on developing a creative model to stimulate creativity in architectural education.

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**Abstract—** In current field of education, learners are demanding for innovative approaches in teaching. This paper is focused on developing new creative model which could be applied on creative stimulation in architectural education. Typical individual centric education will not be sufficient to make learners more creative. It needs more effort from facilitators and creative approaches in teaching. Using creative teaching methods are lacking in current practice and through this article it will describe the effectiveness of having interactive workshops other than individual centric tutoring to modify the pedagogical techniques and to stimulate creativity of learners.

**Keywords—**creative stimulation, cognitive thinking, fostering creativity

## I. INTRODUCTION

Creative education is based on many pedagogical techniques to stimulate creativity in many ways. Fostering creativity is a challenging task with a mixture of talents in one group. However it has been argued in many forums but yet open for discussions, which method will facilitate the user more in improving their intrinsic motivation. Architectural education is based on stimulation intrinsic motivation of students. In a nutshell architectural education is a problem-solving process where students will get tasks to develop architectural schemes with many practical issues and through their design solution they must address all the critical issues related to the given project. However, continues motivation and guidance is needed through the process to facilitate the student and raise his creative levels. It is an obvious factor that students need creative sparks.

Creative spark is something which could stimulate their creative thinking and support on their educational system. Architectural education contains many pedagogical strategies and case-oriented learning is one method of it. Creating supportive environment for students doesn't mean creating physical infrastructure. Physical infrastructure is needed but more than that they need support and guidance on initial stages of their designs or products.

In creative education, facilitator's role is significant. Understanding student's creative levels and creative efforts are important to identify capabilities of the student. The uniqueness of architectural education is giving one to one guidance but fostering creativity through this process is challenging.

In a typical classroom setup there are different types of students with varied skill levels. Some students are gifted and born with creative sense and for others creative

stimulation is much needed. Those students are rich with divine inspirations and highly motivated on creative tasks. However, in architectural education typical classroom consist of 50 – 60 students and it was often true that the ratio of the gifted creativity is 1/10 or less than that. Primary motivation underling with this study is to promote innovation and foster creativity through new teaching model. Identifying a suitable and effective teaching model is needed and it will create a new dimension in creative education. Education has a role to play in retention of creativity. Students need to be facilitated to identify their level of creativity through given objectives and further guidance is needed in delivering better products through this process. Followings are the demanding factors in creative process.

- § Readiness for ideas
- § Creative endeavors
- § Obstacles for creative personalities
- § Creative success.

## II. AIMS AND OBJECTIVES OF THE STUDY

The challenge of contemporary education sector is to create effective learning environments where students could play a major role, however, the integration of knowledge in multidisciplinary sectors is still lacking. However, improvements in teaching materials and design strategies will provide less input for creative stimulation. Nourishing creative thinking and measuring performance are needed throughout this process. Many Critiques state that less interaction with students have a higher potential to influence negatively on creative and cognitive thinking of the participants as it limits mutual learning. Further supporting this ideology, it is stated that when a learner's concentration is focused on individually towards his works it would be rather difficult to interact with others. This conflict of ideologies makes it crucial for academics to conduct an effective comparison between being self-oriented and being more interactive with other students in the designing process. Therefore, the primary aim of this study is to conduct an effective comparison between the creative levels applied in the creative workshops and general student-centric tutoring in architectural education.

It is proven in many cases that the environment can influence thinking. In creative workshop setup students have access to many creative arenas. In general practice, studio-based education does not support multi-learning

methodologies. Therefore, via the comparative study, the researcher shall focus on the outcome of on developing a prototype theoretical model which could be applied in architectural pedagogy to ensure creative stimulation. Through this study, the prime objective is to reshape creative education by delivering a new model to practice fostering creativity.

### **Supporting creativity**

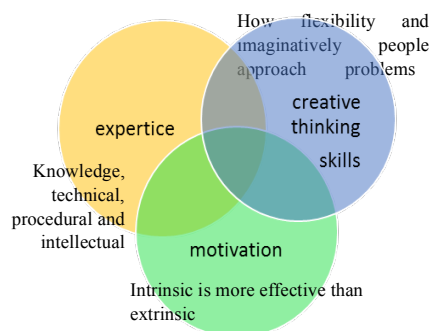
Creativity arises through the confluences of following three components.

§ Knowledge – the source of ideas

§ Creative thinking – depends on the individual approaches to the problem solving process and depends on personality traits and working style of an individual

§ Motivation – intrinsic passion and interest upon any given task. Continues motivation is needed and this needed to facilitate in multiple ways to get more effective results.

### **Three components of creativity** (Karlyn, 2005, September)



### **Knowledge**

Knowledge can be identified as the frozen data base of an individual and the ability to utilize the knowledge arises when there is a problem to solve. Experience, long term focus and analysis on one specific area allow pupils to build long term technical data base related to the specific field and this creates a strong platform to build individual creativity. However, this data base is differing from one to another depends on the education received and background they raised. In an mutual learning background students will get an opportunity to see and experience how the others have utilize their knowledge to solve issues in any given tasks and it will automatically support in transferring knowledge to group of students.

### **Creative Thinking**

Creative thinking is the major element in creative process. The role of facilitator is to understand the level of creativity and giftedness. Creative education has a role to play in retention creativity.

- Readiness for ideas
- Creative endeavors
- Obstacles for creative personalities

- Creative success

The nature of creative minds are usually they seek solutions out of general equation. They are trying hard to innovate a process, system, a product, a theory or something related to their field of study. This motivation needs to be maintained constantly to experience better performance. Usually creativity occurs when an individual make a change to the symbolic system and when this change is adopted or accepted by the social organizations of a domain. However in architectural education applying creativity is more centric on creating spaces and buildings. In this process being innovative means applying and developing innovative architectural languages and creating extraordinary spaces or buildings for human usage, which could create milestones in the relevant field.

Furthermore creativity and intelligence have strong interconnection. There are three main aspects of intelligence which supports in fostering creativity.

- Synthesis (creative)

Synthesis means the ability of creating or formulating new things. This can further differ as the skill of redefining things in new dimensions.

- Analytical

Analysis of ideas and filtration from better to best is another fact which could determine creativity of an individual. It is often proven that critical analytical skills help on evaluating ideas and those have the ability of giving best innovative solutions for the problems identified. However architectural education is problem solving process which needed many creative and analytical skills.

- Practical

When it comes to real practice fancy ideas will not be able to sustain for long because there is no practical application. However the given solutions need to be practical and applicable.

### **Motivation**

Motivation is the most important key component in creative education. Intrinsic motivation is much needed in stimulating creativity and it has shown huge impact on delivering creative products / thoughts. However it is often argued in many forums, which method is more appropriate in stimulating creativity. There can be many suggestions and it can be highly depend on the skill level of the particular group.

### **Studio based education**

Architectural education is a studio based education where students could get individual attention. In typical practice creativity is taught by exercises known as projects. In this process students were assigned with a task and each and every student will come out with different solutions to a given problem. As explained earlier Architectural education is problem solving process where students have to apply the theoretical and practical knowledge they gain from lectures and tutorials to find solutions. Innovative solutions are always encouraging in this process. The



architectural education consists of two main bodies of knowledge, the verbal and practical. (Ali Asasoglu\*, 18 November, 2010)

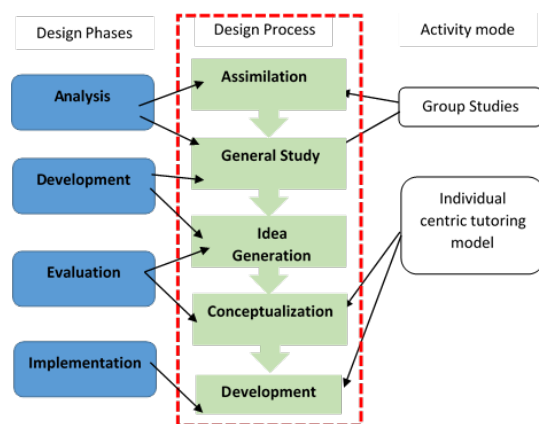
However teaching methods are playing a vital role in this process. Through this paper it will explain the effectiveness of having interactive workshops to stimulate cognitive thinking and facilitate the creativity.

### Teaching style and approach

Typical process of creative studies applied group studies at the initial stages of the design process and with the research outcome of the background study of the given project students have to develop their own schemes accordingly. (Gunaratne, 2018) However this process can be identified as more individual centric approach where facilitator plays a vital role.

### Typical Creative model

Typical creative model facilities students more individually after initial steps of the design process. This make students more individual centric and the facilitator (tutor) plays a major role in grooming his design skills. However through this model students will not get an opportunity to discuss how the others have developed their schemes and to share their knowledge and experience.

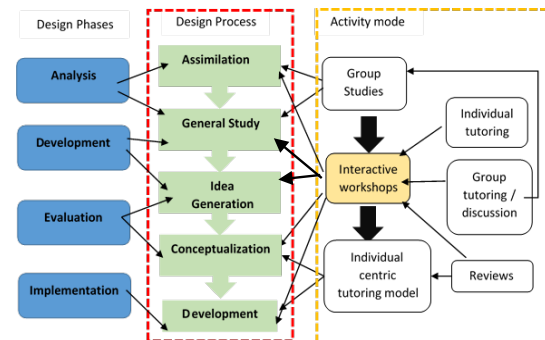


### Effectiveness of Interactive workshops

Changing the style of teaching can make significant changes in student's outcome and changes are needed to generate creative sparks. The author has identified incorporating interactive workshops into creative model helps to motivate more towards the given scope and it allows mutual learning. In typical design process after general study students are oriented in developing own concepts on their project and developing schematic designs. However this process allows students to go

deeper in to their analysis and develop synthesis. But incorporating interactive workshops in between this process allows students to analyze the proposals and concepts developed by the others and it creates a platform to discuss several approaches done by many individuals. Further they have been facilitated by giving comments and adding values by facilitator to make this process comprehensive.

### Creative model applied



Creativity enables the talented designer to transcend the conventional knowledge domains to investigate new ideas and concepts, which could lead them to discover innovative solutions. To mold creativity to a productive solution continues monitoring and effective mentoring is needed. This process is known as “tutoring” in architectural pedagogy. The above-applied model facilitates the students to develop and share the concepts they built and it allows students to understand errors and impractical solutions through experience and mutual learning. It is more productive in concept development stage and scheme development stage where students could learn mutually and they will be further facilitated and supported by tutors to make this process more effective and smooth.

Catering to the needs of the cluster is again an important factor in stimulating creativity. This process make it easier to understand the creative levels of individuals and some students who didn't have intrinsic motivation can be easily motivated to deliver a productive and creative product at the end of the process. (Modupe Akinola, Wendy Berry Mendes, 2008)

Understanding student's creative efforts and effective appraisals will supports heavily on their deliverability. (Anthony Williams and Michael J Ostwald, 2009-2012) Creative efforts are varied from one to one and this process make it open to witness their creative levels in an open forum and automatically supports students to have a

self-evaluation which encourage slow runners to run faster the marathon.

### **Conclusion**

However giving concrete solutions to reshape creative education will not be successful. It needs to be flexible enough to reform and restructured according to the intellectual level of learners. The identified creative model was applied and tested several times and the effectiveness of the process was proven through the results and comments got from the learners. The most important factor discovered is changing the procedure and the routine can make significant changes in creative thinking process. Students were highly motivated and curious to observe the design approaches of the others and it creates a platform to learn mutually through mistakes and appreciating better solutions.

To foster creativity strong leadership and effective management is needed. Being sensitive to student's creative approaches are also important. But it is often

argued, how current academic setup could adopt those changes effectively? There is only one answer for that and it is diversifying the learning experience of the students will not needed much resources but only the creativity approach of the facilitator towards students is sufficient.

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# Automation of Scoring Creditworthiness Using Optical Character Recognition and Probability of Default Calculation Algorithms

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**Abstract**—The automation of determining creditworthiness requires the machine to automatically gather and analyze financial data. Current methods require several man hours of data entry and analysis of data to assess a single case. This paper demonstrates the usage of state-of-the-art Optical Character Recognition (OCR) and Computer Vision (CV) techniques to gather data automatically from scanned documents in a format that can be used to process and analyze data further. This paper also details the novel automation of analysis of the extracted data to find the probability of default (PD) for a specific case. We find that this process reduces the turn around time of granting loans and minimizes human interactions and biases.

## I. INTRODUCTION

Credit is defined as the extension of funds by a creditor based on the belief that the borrower will repay the sum borrowed along with interest. This belief can be measured using the ability to return the sum and the willingness to return the sum borrowed. A good measure of this is calculation of the probability of the borrower defaulting on their loan by measuring the metric of ability and willingness to pay [1]. This calculated probability is called the probability of default (PD). All methods of calculating this require a person to manually extract data from financial documents such as balance sheets, bank statements and profit and loss statements. This process typically takes man hours to do manually. Our work reduces the turn around time of data extraction using state-of-the-art Optical Character Recognition technology to extract data from such documents.

Optical Character Recognition (OCR) is a method of identifying text in a scanned image document. It relies on pre-trained Neural Networks which detect the position of text in the image and then try to classify it [2]. It is a tool that is used to automate data extraction from scanned images. This technology is currently implemented to make scanned documents searchable [3]. However, there are very few implementations of tabulating this extracted data.

Many such implementations rely on tabulating data. However they rely on utilization of horizontal and vertical lines in an image which may not always be present [4]. Our work aims to work around such restriction and operate on any type of source file.

In addition to automation of the process of extracting and tabulating data from financial documents, our work automates the process of scoring creditworthiness. It uses entity recognition to understand the reason of the transaction. This reasoning is then used to predict the willingness of the borrower to repay. The ability to repay is calculated using the withdrawal and deposits information extracted from the bank statement of the borrower. Hence, our work aims to minimize human effort and time taken to return a loan.

The remainder of this paper is organized as follows. Section II provides a background the existing technological advancements in the field of OCR which forms the basis for our work. Section III elaborates on how we leverage the technologies mentioned in Section II for Data Extraction. Section IV demonstrates the analysis done on the extracted data to calculate PD and creditworthiness. Section V concludes and mentions directions to future work.

## II. BACKGROUND

Our work relies heavily on Optical Character Recognition, and skew correction methods. We use implementations of these techniques written in the Python programming language for our analysis purposes.

### A. Optical Character Recognition

Optical Character Recognition (OCR) is the ability of the machine to detect and comprehend characters. It is a multi-step process comprising of the following steps: optical scanning, location and segmentation, preprocessing, and feature extraction and recognition [5].

1) *Optical Scanning*: Scanned documents are often multi-leveled images. Hence, when performing OCR, it is common practice to convert the multilevel image into a bilevel image of black and white using the process of thresholding. A threshold is used, where gray-levels below this threshold is said to be black and levels above are said to be white.

2) *Location and Segmentation*: Segmentation is a process that locates the text within an image. It is necessary to locate the regions of the document where text has been printed and distinguish them from figures and graphics, prior to recognition.

3) *Preprocessing*: Preprocessing involves smoothing and normalization. Smoothing implies both filling and thinning. Filling eliminates small breaks in the text characters, and thinning reduces the width of the lines of the text. Normalization is applied to obtain characters of uniform size, slant and rotation.

4) *Feature Extraction and Recognition*: The process of extracting characters from a preprocessed image is done using a pre-trained neural network. The neural network is trained on a dataset of printed and handwritten characters. After classifying characters the algorithm then joins the text together, using line breaks and spaces as appropriate.

#### B. Skew correction

Skew correction is done using Hough Transform method and the minimum area rectangle method. The Hough Transform algorithm uses an accumulator, a two-dimensional array, to find the line described by the following equation.

$$r = x \cos \theta + y \sin \theta \quad (1)$$

The dimension of the accumulator is two, one for the values of  $r$  and one for the values of  $\theta$ . For each pixel at a certain Cartesian coordinate  $(x,y)$  in the image, the Hough transform algorithm determines if there is enough evidence of a straight line at that pixel. If so, the algorithm calculates the parameters  $(r, \theta)$  of that line. By finding the local maxima in the accumulator space, the most likely line can be extracted. Then the  $\theta$  values are averaged to find the average skew of the image. This skew can then be corrected by rotated the image by the appropriate angle [6].

For minimum area rectangle method, an algorithm tries to fit rectangular bounding boxes around a document. This is done by rotating the document through 360 degrees. Then for each rectangle, its area is calculated. The rectangle with the smallest area gives the rotation or the skew of the document. The image is then corrected by rotating the image in the appropriate direction by the angle calculated in the minimum area rectangle algorithm [7]. For our work we implemented both of these algorithms and use them appropriately depending on the speed and nature of the documents and tasks we are handling.

### III. DATA EXTRACTION FROM SCANNED DOCUMENTS

For the data extraction process for scanned documents, the PDF document needs to be converted into an image to perform OCR on it. In our project, we converted our PDFs to images at 300 pixels per inch (ppi) resolution. This was because we noticed that a resolution higher than this slowed down the process and a resolution lower than this resulted in errors in the OCR. These images are deskewed, that is rotated so that they appear straight, using the minimum area rectangle method mentioned in Section II B. We found that this method is faster than the Hough Transform method and there is a negligible difference in accuracy between the two methods. The deskewing process is necessary as it improves the accuracy of the table extraction algorithm.

We used Google's Cloud Vision implementation of the OCR algorithm mentioned in Section II A. It is based on the state-of-the-art Tesseract OCR engine [8]. We used this implementation because of its ease of use and high accuracy regardless of image skew and lighting conditions. To utilize this, we had to represent the image in a base64 encoding format. Base64 encoding uses capital alphabets (A-Z), small alphabets (a-z), numbers(0-9) and the symbols plus (+) and slash (/) to represent numbers from 0-63 [9]. These values are used to store the color data of each pixel in the image. This was done so that we could send the image as a query to Google's Cloud API.

The result of Google's OCR is a JSON string containing the details of the identified text and their bounding boxes. The bounding boxes depict the location of the text on the image. The units of these bounding boxes are in pixels. Hence, these may vary for the same PDFs if they are converted to images with different resolutions. Before these bounding boxes can be used, the units are changed from pixels to inches by dividing the values by the original resolution, which in our case was 300.

Using these text and bounding box values, our program recreates the PDF and populates it with text. For each page, our program calculates the average font size for the page. The font used for PDF generation is a sans serif font. It is constant for any given input file. This is done to reduce computation time by avoiding a font detection method. It removes the outliers from the set of all heights on that page. It then calculates the average height of text in inches. This is then converted to font size in points by multiplying the average by 50. We use average font size instead of finding heights of each text to reduce errors while extracting tables from this PDF.

The PDF that is created is then passed to a program which extracts tables from the PDF file. We used Tabula, a tool which identifies tables in PDFs and converts them into machine readable Comma Separated Values (CSV) files [10]. This file is the raw output of the table extraction process from the PDF.

However, before this data can be analyzed, it is preprocessed and restructured into an easily analyzable format. This processing is done by importing the CSV out produced by Tabula into a Data Frame data structure. This data structure is a equivalent to a table of rows and columns. The first step in preprocessing involves removal of empty columns. If the column contains more null elements than a certain threshold, which we set to be 80%, it is removed from the Data Frame. For rows, the process is more intricate. Instead of removing the rows completely, they are merged with the row above. This is done to minimize the loss of data while cleaning the CSV file. The CSV extraction process also results in unwanted spaces and commas. These are removed mapping a function that replaces these unwanted characters with an empty string to the entire Data Frame. We also replace the remaining null characters in the Data Frame with empty strings for easier analysis.

We also identify the row which contains the headings. This is done by comparing certain strings such as Balance,

Particulars and Deposits, which denote the start of the bank statement. Once the top row is identified, we discard all the data above the headings row. We then sort the columns into the categories described by the following word bank. We compare the heading strings to the strings given below. Any string that does not fit into our word bank, it is deemed as blank.

'Date': ["date"] , "Description": ["narration", "particulars", "description"], 'Cheq Number': ["chq", "ref"], "Withdrawal": ["withdraw", "debit", "dr"], "Deposits": ["deposit", "credit", "cr"], "Balance": ["balance"]

The output of this process occasionally results in conflicts. This happens when the CSV extractor is unable to tell the difference between two columns. The most common conflict is Date and Description being in the same column. These conflicts are resolved by comparing the data in each column to a regular expression. The regular expression of the date would be numbers separated by hyphens. After resolving conflicts, we merge the blank columns into the known columns using a priority based method. In this priority, Description is given the highest priority and date is given the lowest priority. This is done to avoid text mixing with the date.

Once the blank columns are merged, the Data Frame is brought into a standard form containing the date, description, withdrawals, deposits, and balance. This standard Data Frame is then used for Creditworthiness score calculation.

#### IV. CREDITWORTHINESS CALCULATION

For creditworthiness calculation, recognition and classification of the entities involved is required. For this every row in the data frame, we analyze the description, deposits, and withdrawals to create a textual description of the transaction. The format of the description is A amount was deposited/withdrawn on B date using X method for Y, where A is the amount, B is the date, X is the method of transaction like mobile banking and net banking, and Y is the entity. A and B are directly obtained from the Data Frame, but for X and Y analysis of the description is necessary.

To identify X, our program uses string comparison. It looks for keywords such as NEFT, RTGS, and MB, which denote National Electronic Funds Transfer, Real Time Gross Settlement and Mobile Banking respectively. While this narration differs from bank to bank, a word bank approach can be used to identify such transaction types. For entity recognition, the text is analyzed according to the type of transaction method found. For most transaction types the text can be split using a space and the last two words denote the entity. After recognizing entities, they need to be classified as Personal, Business, Utilities, Salaries, Bank Charges and Other.

For each of the classification categories there is a list of words that describe each category. For personal and business, the user can provide additional words denoting the first name and last name of the person and the sector in which the business is present, along with some potential names of the businesses. For the personal list the word self is also added to the word bank. For business multiple words and their

abbreviations such as Limited, Ltd., Private , and Pvt. are added. For the sake of consistency the strings are compared in lower case only. This reduces errors in the process of classification. Once the entities are classified, our program calculates a creditworthiness score between 300 and 900.

Before the creditworthiness score is calculated, a risk factor is obtained by calculating the estimated gross profit and net profit of the user per quarter. The gross profit is calculated by taking the difference of the sums of deposits and withdrawals in the Business category obtained from entity analysis. The net profit is obtained by subtracting the utilities and salaries from the gross profit. For risk calculations 0 is high risk and 1 is low risk. To identify risk based on these profit values, their average is taken. If the average gross profit is less than 0, the risk is set to 0. If the average gross profit is above 0 but net profit is below 0, then risk is set to 0.8. If both the profits are above 0 then risk is set to 1.

The calculation of score relies on the following factors, all weighted equally. For every case, deposits are positive and withdrawals are negative:

##### 1) Ratio of Bank Charges to Total Deposits (bCTD):

We get this value by summing the withdrawals and deposits under the category of bank charges using the transaction type identified by our algorithm. We subtract this ratio from 1 because these charges should be at a minimum as more bank charges demonstrates bad usage of money. The equation for this ratio is:

$$bCTD = 1 - \frac{bankCharges}{totalDeposits} \quad (2)$$

2) Ratio of Difference in Personal Transactions to Personal Deposits (dPT): This ratio demonstrates how much of money is taken for personal use. A ratio of 1 is ideal as this demonstrates that there is no personal interference in the business. The equation for this ratio is:

$$dPT = \frac{personalWithdrawals}{personalDeposits} \quad (3)$$

3) Ratio of Difference in Business Transactions to Business Deposits (dBT): This ratio shows how much of money is invested for business use. A higher ratio is good, as more investment in business demonstrates better creditworthiness. The equation for this ratio is:

$$dBT = \frac{businessDeposits - businessWithdrawals}{businessDeposits} \quad (4)$$

4) Ratio of Number of Overdraft Transactions to Total Number of Withdrawals (nOTW): This ratio is dependent on number of transactions rather than value. It demonstrates how much of the overdraft limit is utilized. An ideal utilization ratio is 0.5. Hence we subtract the value obtained from 0.5. The equation for this ratio is:

$$nOTW = \max\left(0, 0.5 - \frac{numberOfOverdraft}{numberOfWithdrawals}\right) \quad (5)$$

5) *Ratio of Cash Withdrawals to Personal Withdrawals (cWP)*: This ratio shows the usage of cash by the user. This ratio should be small because more cash usage demonstrates lower creditworthiness. Hence, we subtract this ratio from 1. The equation for this ratio is:

$$cWP = 1 - \frac{cashWithdrawals}{personalWithdrawals} \quad (6)$$

We use these 5 ratios to rate creditworthiness. A raw creditworthiness (rCW) value is obtained using the following equation:

$$CW = risk \cdot 20 \cdot (bCTD + dPT + dBT + nOTW + cWP) \quad (7)$$

The rCW score is out of 100. This is then converted onto a scale of 300 to 900 to obtain the scaled creditworthiness score (sCW) using the following equation:

$$sCW = 300 + 6 \cdot rCW \quad (8)$$

This score is then compared with a known window of score and a rating is awarded. The rating is an exponential correlation with AAA+ = 900 and D = 300. The rating can also be expressed using numbers (n) 1 to 19. These numbers are used to calculate the probability of default (PD) using the following equation:

$$PD = 0.00001 \cdot (n^3) + 0.00001 \cdot (n^2) + 0.00005 \cdot n + 0.001 \quad (9)$$

If the Loss Given Default (LGD) is known and Exposure At Default (EAD) is known, then the expected loss (EL) can be obtained using the following equation:

$$EL = PD \cdot LGD \cdot EAD \quad (10)$$

Expected loss is helpful for calculating the interest rate, if the Return on Risk Adjusted Capital (RAROC) is known. The interest rate (IR) is calculated using the following equation:

$$IR = RAROC + EL \quad (11)$$

With the above factors we can automate the process quantitatively predicting the probability of default and calculate the interest rate from a scanned PDF document of the user.

## V. CONCLUSION

This paper demonstrates the automation of the creditworthiness scoring process using state-of-the-art Optical Character Recognition methods to extract data, string comparison using a word bank for preprocessing, data analysis, and entity recognition, and mathematical equations for calculating the probability of default and interest rate calculations. Future work will include enhancements to the Optical Character

Recognition algorithm, inclusion of more document types such as balance sheets, and addition of factors that determine creditworthiness.

Currently, there is a loss of valuable data because of the accuracy of our OCR. We will improve the OCR accuracy by using state-of-the-art neural network techniques [11]. The increase in accuracy will help us reduce data loss due to OCR and include other types of documents.

The inclusion of other types of documents would require a method of classifying them. The machine would be required to distinguish between a single column balance sheet and a double column balance sheet. This can be achieved using computer vision techniques that by training an image classifier for such documents. The inclusion of more documents in the detection system will enable us to increase the amount of factors that are used to assess creditworthiness.

We can consider more factors such as utility bill payment, income tax return payments, and outstanding loan payments. These factors will help provide a more holistic view for creditworthiness assessment and will provide a more accurate score and probability of default.

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# Analysis of Financial News Using Natural Language Processing and Artificial Intelligence

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**Abstract**—The task of analysis of financial news uses state-of-the-art Natural Language Processing (NLP) and Artificial Intelligence (AI) techniques. The paper demonstrates how NLP techniques can be used to provide succinct summaries, identify keywords and determine sentiment of a certain news article. These features can then be used to make informed decisions that are based on recent, relevant reports. This paper also exhibits a methodology of identifying impact investment using a Naive Bayes Classifier, which can be extended to other financial terminology. We find that the usage of NLP and AI techniques such as sentiment analysis and keyword extraction enhance the information presented in online news articles by filtering out irrelevant content.

## I. INTRODUCTION

Financial markets are volatile and real time updates and analysis are of utmost importance when dealing with them. These markets are susceptible to the global events and phenomena such as trade wars, civil unrests, innovation, and scientific discoveries. Financial News is obtainable from a multitude of sources, both online and offline. Online sources here are defined as those which can be acquired via the internet and offline sources here are those which are propagated via other media. Offline sources include news and insights found via newspaper and television. News obtained via a newspaper is obsolete for a financial market as sensitive as a stock market. News found on television is live, but such news cannot be analyzed with ease. Online sources are more superior in terms of their offline, when it comes to relevance and ease of analysis.

There are many websites that distribute publish and aggregate such news. Some of them include BusinessInsider, BusinessToday and Economic Times. Each of these numerous websites have many news articles each with thousands of words which can be difficult to process for humans. Hence there is a need for aggregating and analyzing such news using modern computer science techniques which will enable humans to make informed decisions.

Such computer science techniques include Natural Language Processing (NLP) and Artificial Intelligence (AI). The definition of Natural Language Processing is as follows. It is a range of computational techniques for analyzing and

representing naturally occurring texts at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a range of tasks or applications [1]. There are many helpful natural language tasks like analyzing sentiments, creating summaries and extracting keywords. Artificial Intelligence is a vast field that aims to understand the intelligent entities and enable machines to mimic these abilities [2]. These state-of-the-art technologies can provide insights into financial news.

Techniques like AZFin leverage textual analysis using NLP to predict stock market prices [3]. However, such techniques are limited and narrowly focused on singular goals and have no means of utilizing real-time data. Data Mining is another aspect that provides good insight into financial news [4]. However, such data mining occasionally results in a lot of data being displayed to the user, with little or no analysis. Our work simplifies the process of aggregating data and then uses modern NLP and AI techniques such as keyword extraction, summary generation and sentiment analysis to extract relevant financial information from news and display it to the user in a succinct manner.

The remainder of this paper is organized as follows. Section II presents the existing technological advancements in the fields of AI and NLP which form the basis for our work. Section III elaborates on how we leverage the technologies mentioned in Section II for financial news analysis. Section IV concludes and mentions directions to future work.

## II. BACKGROUND

Our work relies heavily on certain Natural Language Processing and Artificial Intelligence Techniques. These techniques include summary and keyword extraction using the TextRank algorithm, sentiment analysis and Naive Bayes Classification [5] [6] [7].

### A. TextRank: Summary and keyword extraction

There are two state-of-the-art methods of creating summaries: extraction and abstraction. Extraction algorithms, as the name suggests, summarize an article by scoring the sentences with relevance and selecting the most relevant sentence

based on this score [8]. Abstraction algorithms utilize neural networks to gain an understanding of the meaning of the article, which is then passed on to a natural language generation program that creates a summary [9]. We prefer the extraction strategy because it is not computationally expensive.

TextRank is an unsupervised algorithm for the automated summarization and keyword extraction of texts. The algorithm applies a variation of PageRank [10] over a graph constructed of sentences in a single document. This produces a ranking of the elements in the graph according to which the most important elements are the ones that better describe the text. This approach enables TextRank to build summaries without a training corpus and makes the algorithm language independent.

The function of the original algorithm can be written as: Given  $S_i, S_j$  two sentences represented by a set of  $n$  words that in  $S_i$  are represented as  $S_i = w_1^i, w_2^i, \dots, w_n^i$ . The similarity function for  $S_i, S_j$  can be defined as:

$$Sim(S_i, S_j) = \frac{|\{w_k | w_k \in S_i \& w_k \in S_j\}|}{\log(|S_i|) + \log(|S_j|)} \quad (1)$$

The result of this algorithm is a dense graph representing the document. From this graph, PageRank is used to compute the importance of each vertex. The most significant sentences and words are selected to form the summary and keywords [11].

### B. Sentiment Analysis

The process of analyzing sentiment relies on training the machine to identify positive and negative words using a Word Net. Each word is scored using a  $p$  normalized Kendall  $\tau$  score. The function to calculate this score is formalized as follows:

$$\tau_p = \frac{n_d + p \cdot n_u}{Z} \quad (2)$$

where,  $n_d$  is the number of discordant pairs, i.e., pairs of objects ordered one way in the gold standard and the other way in the tested ranking;  $n_u$  is the number of pairs which are ordered (i.e., not tied) in the gold standard and are tied in the tested ranking;  $p$  is a penalty that is attributed to each such pair, set to  $p = \frac{1}{2}$  (i.e., equal to the probability that a ranking algorithm correctly orders the pair by random guessing); and  $Z$  is a normalization factor (equal to the number of pairs that are ordered in the gold standard) [12].

### C. Naive Bayes Classification

Bayes Classifiers rely on Bayes Theorem. Bayes Theorem is formalized by:

$$p(A|B) = \frac{p(B|A) \cdot p(A)}{p(B)} \quad (3)$$

where  $p(A|B)$  is the probability of A given the probability of B,  $p(B|A)$  is the probability of B given the probability of A,  $p(A)$  is the probability of A, and  $p(B)$  is the probability of B [13].

The classifier algorithm requires a labeled text dataset. The algorithm first identifies various textual features in the text dataset. It works out the probability of finding these features for every unique label in the dataset. These probabilities make up the model of the classifier. When a new unlabeled dataset is given as input to the algorithm, it computes probability of the features found in the model and multiplies all of them. It then compares it to the model and labels the text.

## III. NEWS AGGREGATION AND ANALYSIS

Our work comprises of the following stages: aggregating news, preprocessing the raw data, extracting the summary and keywords from the source text, analyzing the sentiment of the summary and classifying the text as an impact investment.

### A. News Aggregation

For the purpose of aggregating news, we use sources found on the Internet, that is, online news sources instead of offline news sources like newspaper and television. This is done to automate the process of news aggregation and get news updates in real-time. The process of aggregating news is automated using a combination of using web scraping to crawl the Internet for news articles and the Bing Search Engine's News API [14]. The reason we utilize both the sources in conjunction is to increase the categories and articles of news found and to minimize duplication.

The advantages of crawling websites that published financial news was that they sorted their information by sector in which the news was involved. This provides a more focused and relevant output to the user. The Bing Web Search API is used to find articles for user-specified queries that are not a part of the pre-determined sectors on financial news websites. Both tools returned data in the raw HyperText Markup Language (HTML) format. The aggregated data needed to be preprocessed for analysis.

### B. Data Preprocessing

Data preprocessing is important for accurate summarization and keyword extraction. The data that is received using the aggregation is in a raw HTML state. This means that it has unwanted information like HTML tags and advertisements which will result in inaccurate summaries. The preprocessor first identifies all the paragraphs in the raw HTML file and extracts text from them while discarding other tags such as buttons and images. It also identifies the title from the heading tag in the raw. It tries to identify the date published by looking for words such as "date", and "published on". The title, clean text and date are then ready for summarization and keyword extraction.

### C. Summarization and Keyword Extraction

To create a summary and extract keywords we use the methods described in Section II A which have been implemented in the summaNLP python library [11]. The ratio of the number of words in the summary to the original article is 1:5. We find that this ratio creates a succinct summary while preventing



excessive loss of information. This summary is then displayed to the user. Sometimes the articles scraped are really small and cannot be summarized into a meaningful summary. This is usually when the summary is fewer than 4 sentences long. When this occurs, the algorithm return the original article of the text. For keyword extraction, the source text is processed using summaNLP. Our algorithm then identifies duplicates in the keywords output such as plurals, verb/noun forms and different tenses by identifying the stem words of each of the keywords. The duplicates are eliminated and the remaining keywords are displayed to the user.

#### D. Sentiment Analysis

After extracting the summary, we analyze its sentiment by finding out its polarity. Polarity is a measure of the positivity of the article. We do it using an implementation of the steps mentioned in Section II B. This polarity analysis ranges from -1 to +1 where -1 is negative sentiment, 0 is neutral and +1 is positive sentiment. This provides an easily understandable measure for the user and reduces the time spent on learning about the financial state of a certain institution or sector.

#### E. Impact Investment Analysis

Impact Investment is investment in businesses that prioritize social and environmental impact over profit. They differ from non-profit organization and Non Governmental Organizations (NGOs) because impactful businesses operate for a profit [15]. To analyze whether a business is impact investment or not, given an article about it, we use the Naive Bayes Classifier Method mentioned in Section II C. The process of training a machine to identify impact investment businesses involves the following steps: Data gathering, data preprocessing, model building and accuracy testing.

1) *Data Gathering*: We created a labeled dataset of positive and negative articles about businesses in a variety of sectors, where positive articles were those which contained impact investment and negative articles were those which did not contain impact investment business. These articles were aggregated using the web scraping process mentioned in Section III A.

2) *Data Preprocessing*: This data required more preprocessing than the one mentioned in Section III B as the Naive Bayes Classifier (NBC) relies on relationships between words and is case sensitive. The HTML tags and non-letter punctuations are removed from the raw text. This is done to avoid the influence of periods and commas on the result of our model. The entire text is converted to lowercase as the NBC is case sensitive while learning. Stop words, words which are irrelevant to the topic like article, are removed from the text. This improves the models accuracy as it learns to use only relevant textual data [16].

3) *Model Building*: The clean preprocessed data is used to build the Impact Investment Analysis model using the NBC method mentioned in section II C. Our model used eighty percent of the original data for training purposes. Our model had the following most important features:

contains(online) = True neg : pos = 5.8 : 1.0  
contains(time) = True neg : pos = 5.1 : 1.0  
contains(tools) = True neg : pos = 4.0 : 1.0  
contains(end) = True neg : pos = 4.0 : 1.0  
contains(industry) = True neg : pos = 3.8 : 1.0  
contains(people) = True pos : neg = 3.2 : 1.0  
contains(like) = True neg : pos = 3.1 : 1.0  
contains(income) = True pos : neg = 2.9 : 1.0  
contains(services) = True pos : neg = 2.9 : 1.0  
contains(tech) = True pos : neg = 2.9 : 1.0

The above out demonstrates what the machine thinks are important textual features are for identifying impact investment from an article.

4) *Accuracy Testing*: We divided our dataset into 2 partitions, a training partition, that consisted of 80% of the dataset, and a testing partition, that consisted of the remaining 20%. After the training error statistic had a reached a minimum, we found that the model that was built was 92% accurate. So, it is safe to say that the model does not suffer from an overfitting problem.

To use this model with an article outside our dataset, the preprocessing procedure mentioned in step 2 is needed for accurate predictions.

#### IV. CONCLUSION

This paper demonstrates the usage of state-of-the-art technology such as Natural Language Processing and Artificial Intelligence to make financial news more relevant and enable easy decision making. Future work will include enhancing the web scraping process using the keywords found in the initial article analysis.

Our method currently relies on extractive summarization which provides relevant summaries based on what words are repeated. This may occasionally lead to loss of relevant information. One approach to solving this problem is to use abstractive summarization [9]. This will enable our program to provide relevant information in a summary that mimics a summary written by a human.

In our work, sentiment analysis is currently limited to English articles. In the future, we will expand sentiment analysis to other Languages by training Word Nets for languages other than English. Sponsored news may affect the analysis of sentiment. We will also expand the sentiment analysis to identify sponsored news and to adjust the sentiment of the article accordingly.

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# Vehicle License Plate Recognition System

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**Abstract**—This paper presents a method for automatic detection and recognition of vehicle license plates in a Sri Lankan context. License Plates of the still images capturing the frontal view of vehicles are initially located by identifying the regions with the highest vertical edge density. After applying dilation and connected component analysis, the license plate can be localized. The Hough Transformation is used on the extracted plate region to find the skew angle which is used to rotate the plate region to align it with the horizontal axis. Then, the intensity of the plate region is enhanced using morphological operations before obtaining the corresponding binary image. The plate area is further pre-processed before extracting the characters. Boundaries of the characters are identified by the row sum of pixels and column sum of pixels. Extracted characters are normalized to 16 x 10. Then, template matching is used to recognize the characters of the license plate. The developed license plate recognition system has an accuracy of 84% for detecting the number plates of the still images of vehicles.

**Keywords**—Plate Localization, Pre-processing, Character Segmentation and Recognition, Template Matching.

## I. INTRODUCTION

Automatic detection and recognition of vehicle license plates is an ongoing research area. It is widely used in a number of important applications like law enforcement, theft monitoring, access control and automated tolls. Law enforcement applications include speed enforcement and travel time monitoring of vehicles. License plate recognition is also used to control access to parking facilities and it is also used to automatically apply toll charges to users of toll roads. Law enforcement and toll applications benefit from automatic license plate recognition through reducing the need for human intervention.

Automatic number plate recognition (ANPR) is a mass surveillance method which uses optical character recognition (OCR) on images to recognize the license plates of vehicles. OCR is the fundamental technology used in ANPR and it provides the capability to store and sort data. ANPR cameras need to be a special type and set up within certain important parameters. As a vehicle approaches the camera, the software takes a series of 'snapshots' and stores them in a file. When the number plate is of sufficient size for the OCR software the frame is scanned and the registration number of the vehicle is converted to ASCII code (American Standard Code for Information Interchange) and stored in a list. This continues for a series of images according to the speed and position of the vehicle. The list is scanned for similarities and a 'favourite' is selected to retain. Once the ANPR system has identified

the number plate, it is then checked against an installed database for rapid identity verification. The system is capable of locating stolen or wanted vehicles and identifying parking-ticket scofflaws [1].

A basic law of light is that the angle of incidence equals the angle of reflection. However, number plates in the United Kingdom (UK) and most other countries have a special characteristic known as Retro-Reflective. The surface is covered in hundreds of tiny hemispheres which cause light to be reflected back to the source. No matter from which direction the light is directed, it always reflects back and makes them very visible. The camera used in ANPR must be sensitive to the infrared part of the spectrum, to at least 850 nanometres. Then it must be fit with a filter to restrict the visible part of the spectrum. The lens would have a manual iris set fully open and the shutter speed set to 1/1000 th of a second. Finally an infrared source must be fit adjacent to the camera. Therefore, taking advantage of the retro-reflective characteristic of the number plates, the illumination from the illuminator will be reflected directly back to the camera. This is the technology behind successful ANPR capture [1].

Nowadays video cameras are very often used for surveillance because they are cheap and easy to install. Therefore, detecting license plates on still images from a camera or captured video footage is becoming a popular research area as well. Although the best results can be achieved from cameras capturing images using infrared, many researchers are working on the efficient extraction and recognition of license plates out of both still images and video streams [2], [3].

The objective of this paper is to propose a technique to detect and recognize the license plates of still images using image processing principles. A mechanism to achieve the following outcomes are proposed.

- Identification of the number plate region from the rest of the image once a still image is acquired.
- Avoiding the competitive regions and identifying the correct position of the number plate before pre-processing stage.
- Proposing an algorithm to obtain only noiseless white characters in the black background.
- Segmentation of characters.
- Detection of characters using template matching.

### A. Related Work

Various techniques have been proposed in the literature on vehicle license plate recognition [2], [3]. Plate localization is

the first step of these methods. In [4], a colour based technique is used to extract plate regions from a image in a Sri Lankan context. Since the focus was on processing the license plates of the rear view of the vehicles, yellow colour in the license plate is used to extract the license plate region from the rest of the image. But the problem that arises when the vehicle being yellow or the background of the vehicle being yellow is not investigated.

In [5], an algorithm to automatically recognize the license plates of Turkish vehicles is proposed. Input of the system is an image of a vehicle captured by a camera taken from 4-5 meters away. Initially the captured image from the camera is converted to its binary image by applying a threshold value considering the luminance of the input image. To find the plate region, smearing algorithm which is a method for the extraction of text areas on a mixed image is used. With the smearing algorithm, the image is processed along vertical and horizontal runs (scan-lines). If the number of white pixels is less than a desired threshold or greater than any other desired threshold, white pixels are converted to black.

Once the plate region is detected, the next step is to extract the characters from the license plate. Wanniarachchi *et al.* and Choudhury *et al.* in [4], [6] have used row sum of pixels and column sum of pixels together with some threshold values to recognize the true boundaries for the segmentation of the characters.

Next stage is to recognize the characters. Ozbay *et al.* have used template matching with the cross-correlation function to identify the characters [5] where as Wanniarachchi *et al.* have used a neural network to compare each input digit with the standard digits saved in the dataset [4].

Cui *et al.* in [7] provide an approach to extract, to track, and to binarize the characters on license plates from moving vehicles when a sequence of perspective distortion corrected license plate images are given. Initially they have modelled the extraction of characters as a Markov random field (MRF), where the randomness is used to describe the uncertainty in pixel label assignment. With the MRF modelling, the extraction of characters is formulated as the problem of maximizing a posteriori probability based on a given prior knowledge and observations. A genetic algorithm with local greedy mutation operator is employed to optimize the objective function. MRF models can be used to incorporate prior contextual information or constraints in a quantitative way. Here, the presented MRF model-based approach is used to extract characters from multiple frames. The model combines the prior and observations from both spatial and temporal dimensions into a unified framework.

Ajanthan *et al.* incorporated domain knowledge to build an ANPR system that is capable of identifying vehicles even in low resolution video frames [8]. They used Adaboost cascaded classifier for plate localization, Kalman filter for tracking, and SVM for character classification. Although real time recognition is achieved, the training of the proposed system is very time consuming.

In [9], Lin *et al.* propose an efficient license plate recog-

nition system that first detects vehicles and then retrieves license plates from vehicles to reduce false positives on plate detection. Then, they applied convolution neural networks to improve the character recognition of blurred and obscure images.

## II. METHODOLOGY

The Fig. 1 illustrates the main phases of the license plate recognition system applied for a still image.

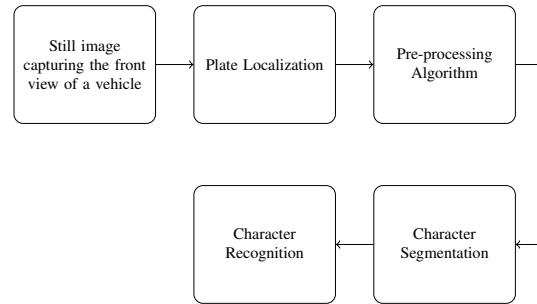


Fig. 1. Vehicle license plate recognition system

The main stages and the corresponding sub-stages can be listed as follows.

- 1) License plate detection
  - Input the original RGB image
  - Obtain the corresponding gray-scale image
  - Vertical edge detection
  - Dilate the image with a 1 x 13 structuring element
  - Remove smaller regions
  - Apply flood fill algorithm to fill holes
  - Label the regions
  - Detect bounding boxes
  - Extract the number plate under certain criteria
- 2) Pre-processing before Character Segmentation
  - Detect the skew angle and alter the image
  - Apply pre-processing algorithm to obtain only the white characters in the black background
- 3) Character Segmentation
  - Segment the characters using row black pixel sum and column black pixel sum (histogram based technique)
  - Resize the characters
- 4) Character Recognition
  - Apply statistical based template matching for detection of English letters and numbers

### A. Extracting the Number plate region

Initially, an RGB image is converted into grayscale. Since the vertical edge density of the number plate area is very high compared to the other regions of the image [10], Sobel edge operator is used only in the vertical direction to detect the vertical edges of the corresponding gray-scale image. The

resultant image is a binary image consisting of the vertical edges. Once the image has been dilated, all the small regions with area less than 100 pixels are removed from the image and the flood fill algorithm is applied to fill holes of the resultant image. A hole is a set of background pixels that cannot be reached by filling in the background from the edge of the image.

Then the filled regions of the image are labelled and the bounding boxes containing the labelled regions are computed. The bounding box with the number plate is extracted from the rest of the image by computing the width/height ratio and the approximate number of pixels that could be inside the box. The experimentally defined threshold values of the conditions used for plate extraction of a still image of size 448 x 336 are as follows.

- $3.8 < \text{width/height} < 7.6$
- $\text{width} > \text{height}$
- $1450 < \text{plate area} < 4500$  pixels

Competitive regions of a properly acquired still image can be avoided by using the fact that the vehicle is bound to be centred and therefore the number plate region should be located somewhere in the mid region of the image.

Although the structuring element that is used here isolates the number plate most of the times, there are situations where the English letters and the numbers of the number plate get divided into two different bounding boxes instead of one. In such a case, there will not be a bounding box to satisfy the above condition whereas a number plate still exists that could have been detected. In order to avoid such circumstances, a new condition is applied to find the boundary of the box containing the two bounding boxes that represent the number plate.

In such images the system scans for the any two bounding boxes such that the following conditions are satisfied.

- Experimentally defined new height/width ratio i.e.  $2.6 < \text{width/height} < 3.6$
- $\text{width} > \text{height}$
- $\text{plate area} > 700$  pixels
- The 'x' value of the starting point of the second bounding box will lie close to the 'x' value of the starting point of the first bounding box + width of the first bounding box

Therefore by using these conditions the system identifies the boundary of the plate.

#### B. Pre-processing before character segmentation

The ultimate goal of this stage is to obtain a binary image of the number plate that consists of white characters on the noiseless black background. The following algorithm is used for this pre-processing.

##### 1) Detect the skew angle

The extracted number plate is rotated so that it is aligned with the horizontal axis before further processing. Hough transformation is used to find the angle of rotation. Every line defined in the Cartesian coordinate system is represented as a point in Hough space.

- 2) Apply 'tophat' operation with a structuring element equal to a disk of radius 10 and reconstruct the image. The top-hat transformation is used to correct the effects of the non uniform illumination. 'Tophat' is a morphological transformation of a gray-scale image [11] which is the erosion of the image  $f$  by the structuring element  $b$ , followed by the dilation of the result with the same structuring element  $b$  where dilation thickens the regions in an image and erosion shrinks them.
- 3) Enhance the intensity of the image. The contrast of the output image is enhanced by saturating the 1% of the intensity values of the input image at its corresponding low and high intensities.
- 4) Binarize the number plate with the following condition.
  - If  $\text{Intensity} < 100$ , then pixel = 1 (white)
  - If  $\text{Intensity} \geq 100$ , then pixel = 0 (black)

The binary image consists of definite white characters. But, although the background is black, it consists of several small white regions other than the characters due to the fact that the extracted plate region is a little bigger than the exact number plate region.

It is observed experimentally that there exists a closed black region in which the white characters are always found. Therefore, if the perimeter of the closed black region can be obtained, the region can be extracted from the binarized image for further removal of the noise in the plate region. In MATLAB perimeter can be extracted for white objects only and therefore the binary image is inverted for perimeter detection [12].

- 5) Get the inversion of the binary image and find the object with the largest perimeter. The inversion of the binary image consists of black characters in the white background that also consists of other small black regions apart from the characters. Once the perimeters of the white objects are obtained it is observed that all the black characters will be inside a particular closed white region with the highest perimeter.
- 6) Find the coordinates so that the largest object is inside a rectangular box. The coordinates are found such that the largest closed region is inside a rectangular box.
- 7) Crop the rectangular area from the original Binarized image.

By cropping the image, the region with the characters is preserved and all other unwanted regions of the four sides of the rectangular box can be eliminated from the original binarized image.

The shape of the largest closed region is different than the rectangular box and since the area of the largest closed region is less than the box, the cropped image may have several small white regions around the black region where the characters reside. In order to convert these white regions to black the following steps have been processed.

- 8) Scan the cropped image from top to bottom and convert

all white pixels to black until a black pixel is found. (Large black region in which the characters are found.)

- 9) Scan the cropped image from bottom to top and convert all white pixels to black until a black pixel is found. (Large black region in which the characters are found.)
- 10) Count the number of black to white transitions row wise and convert all rows less than a threshold to black. The threshold value is experimentally obtained so that the character information is preserved. (Value=9).
- 11) Scan column wise from height/2 to 1 and find the first point where the row sum is zero. Ignore all the rows above. Scan column wise again from height/2 to height and find the first point where the row sum is zero. Ignore all the rows below.
- 12) Scan row wise from 1 to width/2 by consecutive five column sums that have the combination of non-zero, zero, non-zero, non-zero, non-zero and convert all the rows only up to second zero point to black(zero) when the condition is satisfied for the first time.
- 13) Scan row wise from width to width/2 by consecutive five column sums that have the combination of zero, non-zero, non-zero, non-zero, non-zero and convert all the rows only up to first zero point to black (zero) when the condition is satisfied for the first time and find the coordinates to obtain the number plate consisting of white characters on a noiseless pure black background.

After processing the above steps, the number plate with the white characters on the black back ground can be obtained.

### C. Character Segmentation

Once the pre-processing algorithm has been applied, the resultant image is further processed to extract the characters for identification. In order to segment a particular character from the license plate, horizontal and vertical boundaries of the character should be determined. The characters of the license plate are separated and therefore there exists a black region between two such characters. Once the column sum of black pixels is plotted against the corresponding width of the license plate, the 'x' coordinates (vertical boundaries) of the corresponding characters can be identified by the peaks.

The 'y' coordinates (horizontal boundaries) of the characters are obtained by considering the graph of the row sum of black pixels vs. the corresponding height of the number plate.

In this paper, license plates with main upper case English letters and four numbers are recognized. Therefore the Connected Component Analysis is used here to find the position of the first English letter of the license plate disregarding other small characters whether they are present or not.

1) *Connected Component Analysis*: It is a vital technique used in binary image processing that scans an already binarized image and labels its pixels into components based on pixel connectivity (4-connected or 8-connected). Once all groups of pixels have been determined, each pixel is labelled with a value according to the component to which it was assigned. Extracting and labelling of various disjoint and

connected components in an image is basic to many automated image analysis applications.

### D. Character Recognition

The developed system uses Template Matching to recognize the characters. Initially photographs of different license plates are taken and all the upper case English letters and the numbers are normalized to 16 x 10 and the corresponding normalized letter and number image data banks are created to match the input characters.

Basically in template matching, the character matching percentage is calculated by dividing the number of matching white pixels of the input image and the template from the total number of white pixels of the input character and multiplying it by hundred. The shapes of the numbers from 0-9 are distinct and as a result, any number would not have its shape inside another number. Therefore any known input number will have its corresponding highest character matching percentage for the correct template number.

But the highest character matching percentage will not identify the English letters alone. In the English Alphabet there are many letters that can be found inside the other letter shapes. Therefore the possible such letter combinations are found initially and the letters are grouped accordingly. When an input letter is matched with the templates and the corresponding highest character matching percentage is obtained the character is identified. If the identified character is in a particular group as mentioned above, other thresholds are used to find the correct shape of that particular character within its group of letters so that the input letter can be correctly identified.

The thick shape of the letter is not always preserved due to the obtained binary image which totally depends on the image intensity and therefore at times there can be discontinuities within a particular letter or the letter shape might be thin. Therefore when the character matching percentage is obtained, it will not identify the input character correctly. Such situations are also considered when identifying the letter groups.

1) *Letter Grouping*: When the highest character matching percentage (CMP) of the input letter is identified, the corresponding input letter is checked in its group (defined in Table I) to correctly identify the letter from its possible combinations.

2) *Character Recognition -English Letter Analysis*: Classification of a particular English letter from its corresponding group is accomplished by applying certain thresholds to determine the shape of the character. Here when a particular input letter gives the highest character matching percentage, its shape is compared with the corresponding letters of its group. In order to compare the input letter with its corresponding group of letters, the thresholds are defined using the character pixel density of the regions specified in Fig. 2 so that the shape of the characters can be determined. And therefore the letters can be correctly classified.

TABLE I  
LETTER COMBINATIONS ON WHICH AN INPUT IS CHECKED

Input Letter	Group to be checked
A	None
B	B,G
C	C,B,G
D	O,Q,D
E	E,F
F	E,P,F
G	G,B
H	H,N,M
I	I,T
J	B,G
K	None
L	None
M	M,N,H
N	N,M,H
O	O,Q
P	P,B,R
Q	O,Q
R	P,R
S	S,B
T	I,T
U	U,V
V	U,V
W	None
X	X,Y
Y	X,Y
Z	None

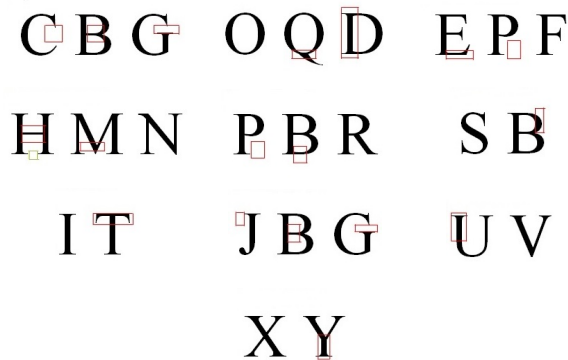


Fig. 2. Pixel densities of the identified letter regions are used to recognize letters within each group.

### III. RESULTS AND ANALYSIS

In order to extract the number plate from the rest of the image, the plate area should be uniquely separated. Since the vertical edge density of the plate area is very high compared to the other regions, vertical edges are detected from the gray-scale images. But the input is a RGB image and therefore it is converted to its corresponding gray-scale image so that the detection of edges can be applied. Once the vertical edge detection is applied, in order to separate the plate region from the rest of the image, dilation is used with a 1 x 13 structuring element. The corresponding structuring element is defined by

conducting different pilot tests so that once the edge image is dilated, the resultant would be another binary image with the plate area appearing as a thick white blob separating from the rest of the image. Resultant images obtained after applying the removal of the small regions with area less than 100 pixels, filling holes, labelling the filled regions and computing the bounding boxes are as given in Fig. 3.



Fig. 3. Row 1: RGB images, Row 2: Grayscale images, Row 3: Detection of vertical edges, Row 4: Plate localization

Fig. 4 shows the results obtained after applying the pre-processing algorithm.



Fig. 4. Row 1: Plate regions extracted, Row 2: Rotated plates to align with the horizontal axis, Row 3: Top hat transformation, Row 4: Enhanced intensities, Row 5: Binary images, Row 6: Results obtained after applying the pre-processing algorithm-white characters in the black background.

#### A. Character Segmentation Results

For example, consider Fig. 5 obtained after the application of pre-processing algorithm. Here, it is observed that there are

unwanted small characters on the left side of the license plate. In order to exclude such characters and to find the position of the first upper case English letter, the connected component analysis is used.



Fig. 5. Position of the first letter is detected with connected component analysis

Here, the 4-connected white objects are bounded by small bounding boxes until the first English letter is reached. Using the letter height/width ratio as a threshold, computing bounding boxes is halted for the second letter once the bounding box for the first letter is obtained. Using the bounding box properties the position of the first Letter can be determined.

Once the position of the first English letter is determined, by plotting the column sum of black pixels against the width of the plate, the other 'x' coordinates of the characters can be obtained.

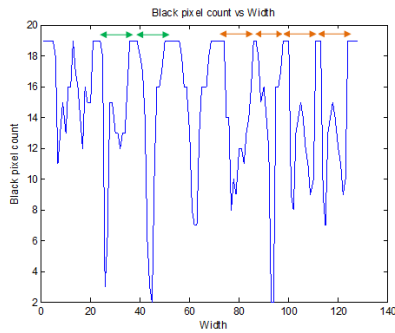


Fig. 6. Vertical boundaries of characters

The green lines in the Fig. 6 represent the 'x' length of the two English letters where as the orange lines represent the 'x' length of the four numbers of the license plate. Since there are no such small characters on the right side of the license plate, the position of the numbers can be easily determined because the first two peaks starting from the back side of the graph would correspond to the 4th number in the license plate.

Therefore by considering the adjacent peaks, all the 'x' positions of the other numbers are determined. But connected component analysis is only used here to identify the first 'x' position of the first English letter.

As mentioned in the Fig. 7 step of the pre-processing algorithm, the plate area is cropped and therefore the height of the corresponding plate is almost as same as the height of the characters. But in order to determine the horizontal boundaries ('y' coordinates) of the characters exactly, the row sum of black pixels is plotted against the height of the number plate.

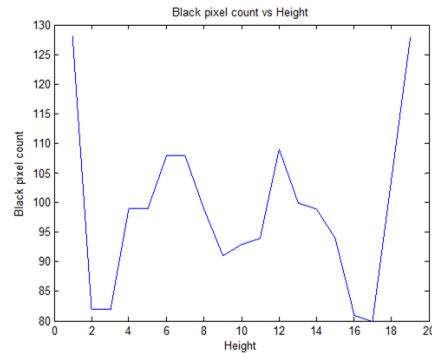


Fig. 7. Horizontal boundaries of characters

#### B. Performance analysis of Vehicle Number plate detection

Still Images of the different vehicles taken in different days are subjected to the system testing and the results are tabulated as follows:

TABLE II  
SYSTEM TESTING RESULTS

Vehicles	Letter Rec	Number Rec	Plate Rec
120	103 86%	109 91%	101 84%

According to the results it can be observed that the numbers have a higher percentage to be detected than the letters. That is due to the fact that the shape of the numbers are distinct and they do not lie on top of one another allowing the highest character matching percentage to represent the corresponding number as described above. Letter with the highest character matching percentage will be further checked with its corresponding group defined previously but still there exists a tendency of characters to be misclassified.

#### IV. CONCLUSION AND FUTURE WORK

In this work a method for automatic detection of vehicle license plates of still images is presented. The developed license plate recognition system is initially tested with 120 still images and it detects the number plates with an accuracy of 84% according to the results. However, when the system is tested on the sequence of frames obtained by a video stream, the detection of the number plates of the moving vehicles demonstrated an accuracy of 80%. Although the number plate region can be extracted from the raw video streams, it was found difficult to carry out further processing of image detection due to the low resolution of the frames.

When the vehicles are moving slowly, the quality of the extracted frame from the video stream of the corresponding vehicle is sufficient for the detection of the number plate. However, when the vehicles are moving very fast, the system is unable to detect the number plates from the obtained sequence



of frames due to blurry nature of the characters in the plate region.

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# Going Green at Office: Lessons Learned on Empowering Green Practices in Sri Lankan Employees

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**Abstract—** Successful targeting of workplaces for empowerment of sustainable practices is critical as majority of time spent by an adult is at a workplace. This study focuses on identifying an effective management tool to enforce such sustainable practices at workplaces. Two samples were selected in two workplace locations in Sri Lanka and observational test was carried out for 3 months. It was concluded that planned behaviour model was more effective than innovation adoption model. Thus, rules and regulations should be imposed along with strong leadership for successful initiation of green practices in an emerging economic office context.

**Keywords:** going green, workplace, employees, planned behaviour, innovation adoption

## I. INTRODUCTION

Although as a species humans have been living a sustainable lifestyle in ancient times, many researchers argue that such sustainable lifestyle is drastically manipulated with the dawn of industrial revolution in mid 1700s and rapid urbanisation experienced since mid-1900s [1]. With the growing demand for natural resources due to enhanced and luxurious lifestyles of post industrial revolution habitants, unsustainable practices were adopted to increase the supply. More specifically, it is evident from figure 1 that more than 1.6 times of earth (biocapacity equivalent) is required to provide natural resources and services consumed within year 2012 which is bearable by earth only in short term. However, prolonged overshooting such as consumption of more fish than oceans can generate or emission of more carbon dioxide than that absorbed by forests and oceans would cause long term resource scarcity or climate change with accumulation of greenhouse gasses in atmosphere [2, 3].

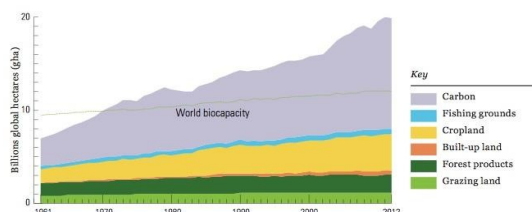


Figure 1: World Biocapacity

Not being a 21st century phenomena, global warming or cooling i.e. climate change has been experienced by earth over a long period of time - from ice ages to holocene periods. Although planetary climate change is nothing new, human induced climate change due to unsustainable lifestyles has accelerated movement from current Meghalayan (MIS 1) interglacial period to next geological epoch with predominant resource scarcity [4]. Hence, it is imminent that mitigation of unsustainable development and lifestyles should be advocated for further existence of the modern world by delaying climate change. Being conceptualized on sustainability and sustainable living which has drawn much attention in the late 21st century predominantly based on threats imposed by climate change, “going green” initiation is focussed on adopting environmentally friendly and ecologically responsible decisions, practices and lifestyles to minimise impact on environment and sustain natural resources for future generations.

However, major drivers for successful transition to sustainable living are two folds. While one being institutional and political enforcement, the other is successful embracement by habitants. As stated in [5] sustainability is interrelated with economic and social dimensions that imposes challenges especially in allocation of resources, benefits and burdens which requires a political and institutional approach for successful implementation. Thus, majority of governments agreed on Paris Accord climate change and adopted global sustainable development goals as a part and parcel of their economic and social policy [6]. Since as a species, humans are expected to shift their lifestyles mutually and exclusively for future generations at expense of luxuries, their positive perception on sustainable living or going green and its benefits are also important for long term successful implementation of sustainability.

Thus, while contributing to current literature on sustainability management, the main objective this study focuses on is identifying most suitable management tools between innovation adoption and planned behaviour when establishing a positive perception on sustainability, especially in the context of work environment and emerging economic moderation.

## II. BACKGROUND

### A. Importance of Workplace

It is often observed that, luxuries provided in a modern workplaces such as air conditioning, daytime lights etc. are unsustainable facilities that are being provided without direct personal expense and not available at their perspective dwellings especially in the case of emerging economic context, would lead to manipulation such as hyper air conditioning that drives unsustainability [7, 8].

Amidst 30 percent of time spent on personal care (sleeping) and another one third of a day between leisure, learning and running chores, it is evident from figure 2 that the balance third of a day is spent by an adult at his or her workplace. Especially the productive time span of a day from 9 am to 5 pm (8+ hours) is spent at a workplace for majority of the global labour force [9]. Hence, many researchers argue that it is important to impose sustainable and go green practices at an office environment as an effective tool to increase sustainable impact of the organisation as a whole and to improve perception and adaptation of sustainable lifestyle by its employees.

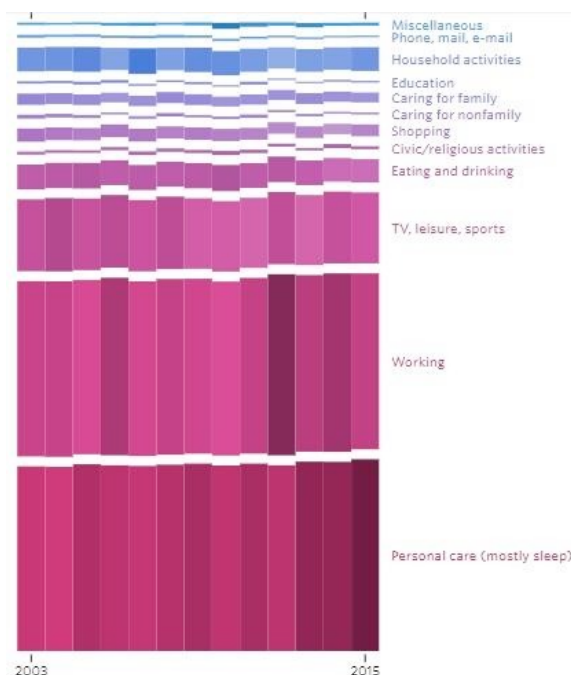


Figure 2: American Adult's daily time usage breakdown from 2003-2015

In addition, a workplace exposes its employees to a different culture, values and ethics systems than that of what they have been exposed at home and by their local cultures. A workplace may include individuals who were exposed to vastly different cultural, social and lifestyle backgrounds which would be amalgamated to a common workplace or organisational culture. Many researchers have argued that informal learning at workplace is one of the most effective and frequent mode of gaining and transferring knowledge within a workplace [10]. Thus, a workplace produces a valuable opportunity to shift its

employees to a sustainable lifestyle through training and exposure. However, it is questionable whether an innovation adoption model or a planned behaviour model would be more effective when persuading employees for the change required.

### B. Planned Behaviour Model

Being backed by theory of reasoned action, Theory of Planned Behaviour (TPB) was first proposed by Icek Ajzen [11]. TPB model extends reasonable action with a three part definition that defines an individual's intention to pursue a certain behaviour. As illustrated in figure 3, (1) an individual's positive perception on suggested behaviour (attitude), (2) perceived control on given behaviour (control), and especially (3) individual's perception that significant other party's requirement to perform given behaviour, shapes the intention (subjective).

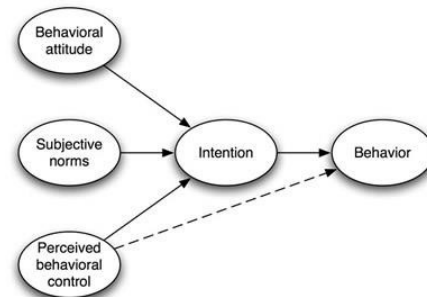


Figure 3: The Planned Behaviour Model

The prominent influential factor for one's behaviour, the subjective norm was considered in this study. Theory suggests that when an individual is imposed with social pressures in forms of either institutional and regulatory or in more social aspects as leadership, opinions, conceptions and peer pressures, the said individual would consider conducting or adopting to a certain and defined behaviour [12]. As an example, an individual might consider being sober as he perceives that others think that he should stop drinking.

Hence, it was further hypothesized that if rules and regulations are imposed on individuals while the leadership commits for continuous motivation, the individuals would intent to adopt a sustainable behaviour.

### C. Innovation Adoption Model

Everett Rogers popularise the theory Innovation Adoption or Diffusion of Innovations that focuses on how and what rate new practices or ideas are spread or perceived among participants in a social system [13]. His 5 part adoption model includes (1) practice or idea (innovation), (2) participants or individuals (Adopters), (3) transfer of information (diffusion channel), (4) passage of time required for adoption (time), and (5) external influences (social system). It is further evident that, in the period of innovation decision process which is progression from

initial knowledge of an idea or practice to decision making of adoption or not, an individual should be continuously exposed to communication of expected new idea or practice [14]. However, while some ideas might be adopted over a short time frame, others might conceive a considerable time period for successful diffusion.

Hence, it was hypothesized in this study that continuous exposure to sustainable lifestyle ideas and practices despite strict imposing of rules and regulations similar to TPB model would successfully diffuse sustainable lifestyle to employees.

### III. METHODOLOGY

To fulfill objectives of this study, two stratified samples from two geographic locations (to reduce bias) were selected with 31 and 39 full-time executive level and below employees respectively. An observational experiment was conducted for 3 months with the aid of independent monitoring of officers who conducted surveys on a synchronised but ad hoc basis for data collection. Communication between employees from 2 different branches that are viable for this study was avoided to further reduce bias between two samples.

“The sustainable practices at work” model was formulated with green practices and tools that are to be adopted by the employees with reference to 4Rs model. Main three categories were defined including Reduce resource use, Reuse of resources and Beautification. Five green tools were defined under reduce resource category as; (1) Reduce printing and use soft copies as possible, (2) switch off air conditioner, lights and fans when moving out from cubical or room, (3) enable power saver in laptops and PCs, (4) Increased usage of daylight, (5) Bulk purchase of paper bundles, tea boxes and cleaning detergents. Four categories were defined under reuse of resources category as; (1) reuse of one side printed paper for internal document printing, (2) No polythene lunch sheet but reusable containers, (3) No PET bottles but reusable glass bottles, and (4) Reuse of cardboard packing boxes and bottles. In addition, inclusion of personal desktop plant on preference were considered under beautification category.

The first sample was exposed to a series of continuous workshops on green practices and green tools which were introduced to test the Innovation Adoption Model. On the other hand, employees from the second sample were imposed with a series of regulations and guidelines on implementation of the same green tools, without exceptions, to conduct control experiment on planned behaviour.

A paired sample T test was conducted to identify progress of perceived behaviour on green practices by two samples.

### IV. RESULTS AND DISCUSSION

It was evident from the paired sample T tests that there is strong evidence on planned behaviour model is an effective tool to impose green and sustainable practices among employees whereas the effectiveness of innovation

adoption model in diffusion of green and sustainable practices among employees was not evident.

#### A. Innovation Adoption Model

It was hypothesized that under innovation adoption model when employees are exposed to green or sustainable lifestyle tools, such proposed new ideas or practices would be defused to employees and they would adopt to a new sustainable or green lifestyle at workplace. However, the results rejected the said hypothesis.

Major contributor for result would be the fact that sustainable or green lifestyle was introduced as a set of informal rules in this model. Although not deliberately imposed through a political process, informal rules plays a crucial role in cultural transition [15]. However, it is further evident that informal rules tend to make a shift in organisational culture slowly or would not result in a change in some cases as imposing is not deliberate [16]. Thus, one can argue that amidst stress and intensity of their day to day work schedules, interest on such sustainable practices declined overtime within employees in the sample since adoption of the sustainable or green lifestyle is an “optional” or informal rule that the employees should adhere.

#### B. Planned Behaviour Model

Considered hypothesis under planned behaviour model that focuses on imposing rules and regulations for empowerment of sustainable or green practices and lifestyles with commitment from leadership and a monitoring and concession mechanism resulted in strong positive outcomes.

An employee’s significant perception on adhering to social norms and pressures exerted on their intention for adoption of a new behaviour by leadership and imposed formal rules and regulations resulted in positive outcome. In contrary to innovation adoption model where the behavioural change is expected through informal or optional rules, sustainable or green lifestyle practices and tools were embedded in organisation’s formal rules that requires a deliberate change in institutional culture in TPB model [17].

It is important to note from the informal interviews with TPB sample that, although the sustainable lifestyle practices are imposed as formal rules and regulations of the organisation, the employees consider such initiation as a motivator and continuous reminder for behavioural change rather than an additional burden or a discouragement. It was also evident from both samples that, perceived behaviour control of employees on intentions of practice sustainability might be obstructed by belief of their impact on unsustainable issues such as climate change is minimum although they adopt new behaviours. Thus, continuous encouragement and motivation which is indirectly provided by TPB model is required.

## V. CONCLUSIONS

With the growing concern on climate change, majority of international organisations, governments, public and researchers have expressed their interest and focus on sustainable living. Since one third of an adult's day is spent at a workplace, it is essential to integrate sustainable lifestyles in working environments to create a wholesome impact on sustainable living. However, challenges are imposed when considering implementation and management of such sustainable or green practices in workplace environment when integrating sustainability to organisational culture.

It was identified through this study that a planned behaviour approach where the sustainable workplace practices are identified as formal rules and regulations of the organisation is an effective management tool when implementing and managing sustainable workplace in emerging economic context.

However, innovation adoption model would be successful with more and more inclusion of Gen Y and millennial who are greatly concerned about the environment and sustainability which they have grown being considered as a part and parcel of their culture.

Future studies are recommended with samples that encompasses more Gen Y segments and also on repetition of the results of this study over a prolonged time period than 3 months.

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## **POSTER PRESENTATIONS**

# Video Based Vehicle Tracking and Monitoring System

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*Abstract*— Computer vision technology has paved the way to process video based traffic monitoring as an alternative way to traditional monitoring methods. In vehicle traffic monitoring, there are three main tasks namely vehicle detection, tracking and classification. This paper presents a feasible solution for vehicle detection, tracking and classification from a video via extracting and analyzing video frames. The background is modeled using a background model and the foreground is estimated using background subtraction. Then after applying morphological operations, the presence of a vehicle is detected on the foreground and classified according to its type. The system is also able to count the number of vehicles within a defined region of interest.

*Keywords*—background modeling, background subtraction, foreground estimation, vehicle detection & tracking, vehicle classification

# An Analytical Study on the Impact of Workplace Interior Ambience on the Worker Performance & Satisfaction with the Use of Branding & Colour with Special Reference to Private Sector Office Interiors

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*Abstract*— In today's competitive business environment, private sector companies can no longer afford to waste the potential of their workforce. Workforce is the key asset for any company and optimizing the worker performance and their level of satisfaction is essential in achieving better human resources. There are 6 key factors in the employee's workplace interior design according to the literature that will significantly influence the individual performance and their level of satisfaction.

Firstly, the requirement is to identify the key components needed to create a positive interior ambience. Once they are identified then conduct an analytical study to see the weightage, colour and Branding aspects carry in relevance to creating such a positive ambience. An analytical study will be carried out to identify the correlation between colour and branding with worker performance and their satisfaction.

This research will be conducted with 5 case studies. The key factors that determine the interior space quality are Lighting condition, office furniture layout, ventilation, openness, comfort and ergonomics, colour and branding. Research is conducted with all these variables taken as independent variables and colour and branding will be the dependent variable. The context will be 5 local private IT offices and the research is done with 25 – 35 years aged, executive grade office workers who are spending an average of 8-10 hours in the office environment.

Further this study is aimed at finding the correlation between worker performance and satisfaction. Studies have revealed that worker performance is depending on key factors and the office interior is one of them. When a workers' performance is high his/hers' confidence levels rises and results in a hike of satisfaction. Yet satisfaction is also relying on few key indicators. So the objective is to identify these factors and see their impact on the subjects.

**Keywords**—*interior design, interior design quality of the workspace, worker performance, worker satisfaction, colour and branding, impact of office interior design*



# A Semiotic Analysis of Visual Representations And Perceptions of Kandyan Buddhist Narrative Art

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**Abstract**— This research specially focuses on visual semiotics of Buddhist narrative art in Sri Lankan context. To be precise the visual syntax and iconology used, their representations and perceptions will be analyzed in depth. Connecting semiotics and cognitive perspective is beneficial and the interdisciplinary approach would lessen the potential ambiguity of visual anthropology. Developing a new meta-language for art interpretation of non-western art traditions is crucial. Panofsky's theory of iconography and iconology has been adopted as the starting point and other different approaches are also been considered in analyzing and interpreting the Sinhalese Buddhist art tradition of Kandyan era. It was argued by some researchers that Panofsky's conceptual model is more biased towards Western art tradition but ignores or rather misrepresents artistic traditions of non- Western cultures. Artistic traditions emerge and evolve based on many factors such as context, artist and purpose etc. Therefore, art strives for transparency and stable interpretation. Yet, art interpretation is not an easy task as it needs familiarization of many other disciplines such as poetry, literature etc. parallel to the particular art tradition. Furthermore, believes and socio-cultural background of the era should also be taken into consideration. The intermingling nature of different fields has made the identification, description or interpretation of art complicated. Semiotic theory (Saussure, 1959; Culler, 1986) and visual rhetoric (McQuarrie and Mick, 1996; Scott, 1994) hold that visual language predominantly varies from one culture to another; much in the same way that textual language varies. As the recipients of the visual messages may not be a homogenous group, their interpretations of visual messages will always vary. Yet, the author intends to analyze culturally defined symbols with special reference to Kandyan Buddhist narrative art thoroughly through the study in order to come to inferences.

**Keywords**—*visual narrative, communication and cognition, buddhist art, visual representations, visual interpretations, human perceptions, semiotics, visual syntax, iconology, visual ethnography, visual anthropology, visual sociology*

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# Using Technology to Enhance Learning Among Undergraduate Business Students: A Sri Lankan Case Study

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**Abstract**— In the context of Higher Education (HE), there has been much debate about the increasing use of technology to enhance student learning. Walker et al (2016: 441) capture very well the reasons behind technology-enhanced learning (TEL) developments in HE when they highlight its role in ‘enhancing the quality of learning and teaching, meeting student expectations and improving access to learning for students off campus’. However, while it has been argued that technology has not fundamentally changed teaching practices (Henderson et al, 2017; Kirkwood and Price, 2013), students report how several technologies and applications have helped with their learning, research and collaborative activities (Henderson et al, 2017). If, as Selwyn (2016: 1006) suggests, ‘digital technology is now woven deeply into the fabric of university teaching and learning’, a better understanding is needed of students’ satisfaction with the level of technology usage and also their experiences of effective and ineffective use of digital tools and technologies to enhance their learning. The paper aims to address the question posed by Kirkwood and Price (2014: 7) of ‘how technology enhances learning and what value is being added to learners’ experiences’. It focuses on two particular aspects of technology usage in HE: (1) to what extent are students’ expectations regarding the level of faculty usage of technology and digital applications met? and (2) what positive and negative experiences have students had regarding faculty usage of digital tools and technologies to enhance learning?. To address these questions an exploratory study was undertaken at University College Dublin’s (UCD) College of Business. An online survey was distributed to 6,956 students enrolled across four campus locations Dublin, Singapore, Hong Kong and Sri Lanka – and 1,009 survey responses were received. The sample included full-time and part-time students enrolled on undergraduate and graduate taught business programmes in the 2017/18 academic year. This research paper focusses on UCD College of Business’ students completing their undergraduate degree in conjunction with the National School of Business Management (NSBM) in Sri Lanka. The survey was distributed to a total of 1141 students in Sri Lanka with a response rate of 123 representing just over 11% of the sample size. The survey was designed to explore three key aspects of technology in HE: ownership and use of technology devices and applications; lecturers’ use of technology devices and applications; and students’ own evaluation of their digital skills. Considering the role of lecturers as facilitators and curators of student learning, only findings relating to the second aspect of the survey – lecturers’ use of technology devices and applications – are reported on in this paper. An initial cohort analysis of the responses by age, campus location, mode of study (full-time/part-time) and level of study (undergraduate/graduate) revealed very few differences in students’ expectations and experiences of the use of technology and applications. Overall, though, the findings provide a considerable degree of confidence that students’ initial expectations of technology usage are being met. Over three-quarters of respondents reported that their lecturers use technology and applications for teaching-specific purposes either more than or at least as much as they had expected. However, a significant percentage of respondents would like to see their lecturers make even greater use of technology and applications and almost half suggest that a greater use of technology could potentially improve class attendance and active participation by students in the classroom. In examining how technology might improve a student’s learning, respondents gave 372 examples of an effective use of technology by a lecturer. Many of these examples relate to the use of video; quiz/polling tools; gamification; PowerPoint slides; lecture capture; online classes; and several application-specific tools. 166 examples of an instance of technology usage that did not support an individual’s learning were also cited. Among these examples include lecturers’ reliance on the use of PowerPoint and video; non-engaging content; the look, feel and functionality of the learning management system (LMS); lecturers who do not use the LMS; lecturers who prohibit the use of laptops in the classroom; and problems with the technological infrastructure. While the literature may suggest that students are not actively calling for universities and faculty to dramatically increase their use of technology and that they prefer a more moderate use of technology in their studies (Caruso et al, 2005; Lohnes and Kinzer, 2007), our research highlights students’ desire for even greater technology usage in the classroom. The results of the study are used to further develop the TPACK (technology, pedagogy, and content knowledge) framework developed by Koehler and Mishra (2009). The results will also provide faculty with examples of technology tools and applications that support student learning and these examples may be useful when designing modules and planning classroom delivery with a view to maximizing student learning and engagement.

**Keywords**—higher education, e-learning, technology, LMS

# Challenges in Integrating Variable Renewable Energy Sources into Electricity Grids - A Review

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**Abstract**— Variable renewable energy sources like sun, wind and tides produce intermittent power. Integrating power generators producing intermittent power outputs to the electricity grid is a challenging task since the power requirements of the loads connected to the grid do not follow the intermittency of the variable renewable energy sources. The technical challenges arise from the fact that there needs to be a balance between supply of power and demand, at all-time scales. In this research, variable renewable energy sources are reviewed, the problem of intermittent generation is analyzed and the solutions for intermittency are investigated, including geographical diversity, forecasting, generator flexibility, energy storage, curtailment, and load control. The final solution to intermittent generation will be a suitable mix of above methods.

**Keywords**— *tourist guides, tourists, contribution, socio economic characteristics, interaction, tourism industry, Sri Lanka*

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# Contribution of Tourist Guides in Promoting Inbound Tourism in Sri Lanka

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**Abstract—** The prime objective of this study is to identify the contribution made by tourist guides in promoting inbound tourism industry in Sri Lanka. Although, it is a known fact that tourist guides play a critical role in the tourism industry in satisfying the tourists, the importance and the role-played by the guiding profession has not been much investigated by Sri Lankan scholars. In addition, attempts have been made to explore the socio economic characteristics of the tourist guides and to whether such characteristics have any significant impact on their performance with special prominence to education, experience and language proficiency. Further, the interaction and the relationship tourist guides build with tourists during the tour were observed. Tourist guides' understanding of their roles and responsibilities towards stakeholders in the tourism industry were also measured. Accordingly, it was intended to identify the areas policy makers should focus in improving the performance of tourist guides in order to achieve a sustainable development in the tourism industry. Micro level data were collected from fifty tourist guides by using standard questionnaires and conducting face to face interviews. The structure and trends of the tourism industry were captured through the secondary data obtained from various sources which include books, reports, articles, periodicals, pamphlets and other publications available in the electronic media. Both primary and secondary data were analyzed using qualitative and quantitative techniques. In order to derive the outcomes statistical methods as well as descriptive studies were utilized. The findings of the study reveal that level of education and experience positively influence tourist guide's ability to handle many tourists for a year. Further, the investigation proves that the interaction between the tourist guide and the tourist and the length of the relationship they build has an influence on repeat visits and recommendation to other tourists. As a central agent who work across all the sectors in the tourism industry, tourist guide play variety of roles in response to the expectations of various stakeholders in the industry. Therefore, the roles and responsibilities fulfilled by the tourist guides towards other tourism stakeholders were evaluated in this research. Finally, the study concludes with the policy implications and the suggestions for future researches in this area.

**Keywords—** *tourist guides, tourists, contribution, socio economic characteristics, interaction, tourism industry, Sri Lanka*

# Geographical Indications and Rural Development in Sri Lanka

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*Abstract*— Geographical Indications (GI) identify products, which originate from a specific geographical origin where quality, reputation or other characteristics are essentially attributable to the place of origin. They create collective property rights upon the producers of the particular region. When the message of uniqueness of products formed by human factors and natural factors passed to the consumers, it is considered that it impacts the rural development positively. This research aims at identifying whether Sri Lankan GI legal framework is potential to benefit rural development. The lessons stemming from European Law and Indian Law pertaining to GIs are taken into account in this regard. This research is mainly relied upon black letter law where statutes, international conventions, legal treatises, journal articles and conference proceedings were used extensively. Furthermore, socio-legal analysis was also conducted in order to gather empirical data. The findings on EU experience reveal that GI protection has contributed to the rural development. The Indian scenario is difficult to absorb since it has been a short period from the time when the GI Act of India was established. However, there is evidence in India too which shows its contribution towards rural development. Hence, it is recommended to reshape the Sri Lankan GI legal framework in order to promote producers and the specific geographical regions.

*Keywords*— *geographical indications, rural development*

# Is the Law Sufficient to Protect Consumers Against the Manufacturers Marketing Immotions By Unfair Advertising: A Comparative Analysis Of The Competition Law In Sri Lanka

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*Abstract*— “Exaggerated claims of quality and selective discussion of the position attributes of a product or service are common and expected advertising practices (J.P.Nehf)”. Given the importance of the multiple mechanisms in the consumer protection Jurisprudence, this essay discusses the legal framework of advertising with examples in lite of consumer protection Jurisprudence. Advertising plays a key role in the modern consumer society. While advertising makes available to consumers information which the advertiser wishes the consumer to have, it raises certain fundamental questions concerning its objectives and the techniques that are used. It is also alleged that advertisements tend to promote consumption by playing with consumers emotions and provide little information that are useful for evaluating competing products. It is therefore assumed that it is essential to regulate advertising. It is hereby critically evaluated that the above statement in the light of competition law and policy based on the legal regimes that is prevailing in Sri Lanka with that of Germany. It seeks to further scrutinize whether the advertising strategies are in line with the Competition Law and policy. Legislation and regulations, their effectiveness, inefficiencies and limitations to provide adequate protections to the consumers. It is further analyzed misleading, deceptive, false, comparative advertising and Unfair Competition to observe whether the present advertising strategies play out with emotions of the consumers other than providing appropriate information and proper comparisons. It is hereby promotes fair comparative advertising to increase a healthy competition which can be adopted to protect consumers and for them to provide information that are useful for evaluating competing products. Anticompetitive advertising in the present day context in Sri Lanka and is compared with the German Unfair Competition Act (UWG) for a better contrast and conclusion. The necessary data and information are simple surveys, discussions, Published articles, books, journals and decided cases and relevant Acts have been used and analyzed to conduct this essay. In addition, many internet articles and web sites are referred to this work.

*Keywords*— *unfair competition, consumer protection, unfair advertising, Consumer affairs authority act, unfair competition act*

# IP Solutions for Green Technologies: Prospects and Challenges for Sri Lanka

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*Abstract*— In recent decades, the world community is grappling with a number of environmental issues, such as global warming, emissions of greenhouse gases and climate change. Undoubtedly, innovation in the field of green technologies is necessary to find solutions to slow down, halt, and mitigate serious and far-reaching negative consequences flowing from afore-mentioned global problems. In this regard, intellectual property (IP) rights or ‘the global currency of innovation’ may be seen as a valuable tool to promote the development and diffusion of green technology. Undeniably, IP law is a dynamic field; its ever-changing landscape challenges IP community to constantly revisit the existing laws and policies. Therefore, the IP system provides the regulatory framework and necessary incentives innovation and creation. The concept of IP protects finest creations of human mind and therefore innovative ideas, creative designs and powerful brands are legally protected by the IP system. Although ideological currents of promoting green technologies are sweeping through the developed and emerging economies, in recent years, the protection of clean technologies remains a largely unexplored option in Sri Lanka and many parts of the South Asian region. Even though there is no clear-cut definition of the term ‘green technology’ it may encompass; technologies protecting the environment, less polluting technologies, technologies using resources in a more sustainable manner, technologies aiming at recycling of waste and products and technologies handling residual wastes.

From an IP perspective, ‘green inventions or environmentally-friendly inventions’, such as those involve energy efficiency, alternatives to fossil fuel and carbon generation, water purification, recycling, renewable resources, energy efficient consumer goods, energy efficiency improvements etc. can be protected under the current patent system of Sri Lanka. Moreover, certain types of technologies can be accorded an IP protection under the trade secret regime. In marketing green technology products, trademark system can serve as an effective tool for branding and advertising. Interestingly, green building designs and structures can be accorded an industrial design protection. Against this backdrop, this research explores the best possible ways of incentivizing green technologies without creating stumbling blocks and barriers for technology transfer to industrial sector in Sri Lanka. It also offers new insight into potential use of IP tools by Sri Lankan industrial landscape in order to reach sustainable development goals and achieve much-needed transition to a green economy, while ensuring affordable access to clean technologies.

**Keywords**— *green technology, intellectual property, sustainable development*

# Application of Graded Response Model (GRM) to Investigate Item-level Statistics of the Sinhala Generalized Self-Efficacy Scale (S-GSES)

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**Abstract**— The Sinhala Generalized Self-Efficacy scale is a culturally adapted and a validated psychometric scale used to assess the efficaciousness of Individuals. Self-efficacy encompasses a person's ability to effectively deal with challenging demands and stressful situations. Exploratory factor analysis conducted in the years of 2015, and 2018 demonstrated unidimensionality, and an internal consistency reliability coefficient of  $\infty.818$  and  $\infty.860$  respectively. To further demonstrate scale's ability in assessing self-efficacy, item level statistics was investigated in the current study (n=144) using Item Response Theory. Thus, Fumiko Samejima's Graded Response Model was utilized. All the items were tested under the constrained version and the unconstrained version of the Graded Response Model. The constrained model demonstrated high discrimination across all items ( $D = 3.190$ ) demonstrating each item's ability in assessing self-efficacy. The unconstrained model demonstrated high discrimination for all items except for items 3, 6, 7, and 8. The items identified to produce low discrimination were tested under the Test Information Function (TIF) to investigate the degree to which each of the items explains the latent structure. Results indicated items 3, 6, 7, and 8 to explain 85.52%, 83.3%, 89.93%, and 89.66% of the latent structure respectively. Further investigation on the overall Item Information Curves (IICs) suggested a strong ability of items to measure self-efficacy of individuals at varying levels of ability. All the items demonstrated outstanding discrimination and ability to explain latent structure, confirming the scale's construct validity.

**Keywords**— *Graded Response Model, Self-efficacy, Exploratory factor analysis*



# Real time Water/Liquid Level Measuring and Alert System

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*Abstract*— In this project I created a real time water/liquid level measuring system. The main objective of this project is to predict flood conditions and to save human lives and to reduce the economic damage which can happened because of natural disasters. There are three main components in this project. First one is the Sensor unit, this calculate water level measurements using Ultrasonic Range finder sensor. Then send those measurements to the Server. The second main component is the Multi-threaded Server Application, which is running on the server. Server application catches the data, which sent from the sensor unit and save those data into the database. This application can catch multiple data sent by the sensors separately at once. Third main component of the system is the Web Site. This shows all the data sent by the sensor units. In Sri Lanka there is no fully automated real time system to measure and predict flood situations. The existing process to monitor water levels is by manual calculation and processing of data and take decisions according to the information. Official person has to go to the measuring point and then he takes water levels. This system can't identify the unexpected high-water levels and there is no any mechanism to measure water levels 24/7. In bad weather conditions this manual process can be fail. Unlike the existing manual system, this system does not require the user to take water levels. This is a fully automated process. Officials of the irrigation departments and other government responsible parties can use these data for their purposes. The main disadvantage of the existing system is, it is not automatically processed and can't do in 24/7. After implementing a system in this caliber also leads to measure water levels from the far away places from the irrigation department offices. Water levels, which are sent by the sensor unit, can be compared to the manual process values to ensure the accuracy of the system.

*Keywords*— *water levels, flood, predict detect, alert, automated*